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VOLUME 33 NUMBER 1

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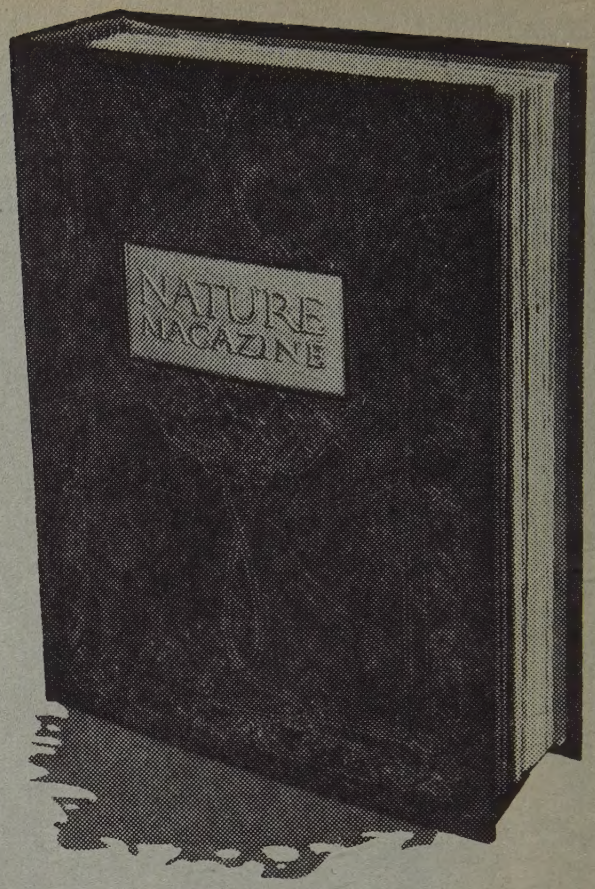

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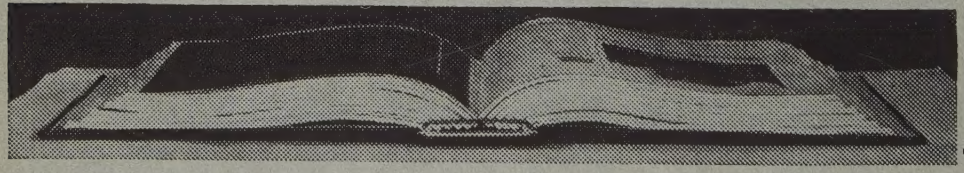

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Frank W. Hutt

In Taunton, Massachusetts, there is an organization known as the Old Colony Historical Society, established to preserve the history of this region. Its secretary is Frank W. Hutt, to whom one may turn with confidence for information on Massachusetts' history. Mr. Hutt, however, is not a one-track historian, but is, also, a local Burroughs, observing and studying Nature and writing of it in what is, unfortunately, relative obscurity. Under the heading "Echoes from the Woods and Barrens", Mr. Hutt writes a regular column in the *Taunton Gazette*. Delightfully written, this column must by now be something indispensable to many of the newspaper's readers. We do not know whether there is a Nature Club in Taunton, but if there is not we should think that all Mr. Hutt would have to do would be to suggest that one be formed among the readers of his "Echoes". He has kindly sent to us, from time to time, clippings of his column and we have read all of them with interest and appreciation. Thank you, Mr. Hutt, and congratulations to the *Gazette* for having the opportunity to publish these words of the outdoors.

A Lost Dog

One of our readers living near Philadelphia lost, in that metropolis, a much-loved dog. He was just a dog, and not one that might be stolen for profit. Advertising, the police, the S.P.C.A. and the pounds were all tried, but to no avail. The experience moved the lady to suggest the formation of a "National Dog Protective Association". She visualizes a non-profit organization to which dog owners would belong, and which would be a clearing house for the report and search for lost dogs. Using the radio and other means, our correspondent proposes, the hunt would be quickly started. She found need for quick action, for the Philadelphia pound, for example, kills dogs at 11 a.m., including all dogs picked up as recently as 2 p.m. the preceding day. Our reader suggests a national scope for the organization so that distant problems could be handled. There is a real opportunity for some such organization; assuming enough dog owners would join. It might well exert influence for greater uniformity in the licensing and recording of dogs. It might issue a uniform dog tag with name of dog and owner and address. It might do a lot of things to bring some order out of the present chaos. We hope someone will take it up.

Garden Book

In the more than twelve hundred pages of the volume entitled *America's Garden Book* is packed an amazing amount of information for the gardener. The title suggests that this book is intended to be the final word in garden books of general character, and the publishers, Charles Scribner's Sons, describe it as the "most complete garden book ever published". It is the work of Louise and James Bush-Brown. A careful scrutiny of the table of contents suggests that the claim of the publishers is no vain boast and that the three and one-half dollars asked for this volume is a fine investment for any gardener.

Sells 19 Features In Six Months

"I have sold, up to date, nineteen features to the Detroit Free Press and have been made their correspondent here," writes Mrs. Leonard Sanders of 1432 Putnam Ave., Detroit, Mich., on completing the N.I.A. course. Her skilful handling of feature stories was the reason given by the editor for her appointment. Mrs. Sanders' first feature was sold less than four months after she enrolled with N.I.A.

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If the latter course is the one of your choosing, you probably *never will write*. Lawyers must be law clerks. Doctors must be internes. Engineers must be draftsmen. We all know that, in our times, the egg does come before the chicken.

It is seldom that anyone becomes a writer until he (or she) has been writing for some time. That is why so many authors and writers spring up out of the newspaper business. The day-to-day necessity of writing—of gathering material about which to write—develops their talent, their insight, their background and their confidence as nothing else could.

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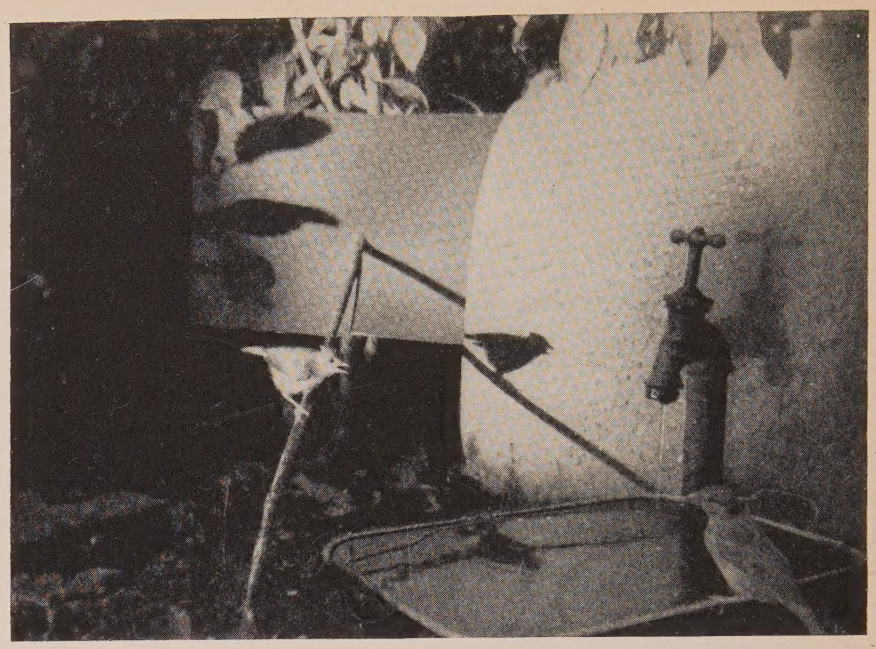
Camera Trails

BY NORRIS W. HARKNESS



CO-WINNERS IN THE PHOTOGRAPHIC CONTEST. ABOVE, TUFTED TITMOUSE AND ENGLISH SPARROW COME TO DRINK. PHOTOGRAPH BY KINSMAN E. CRUMB. BELTED KINGFISHER. PHOTOGRAPH BY A. HAAK.

Of Various Interest

Your letters of comment and suggestion are most helpful, and your interest as shown by your sending them is appreciated more than I can express. Please keep them coming.

It is interesting to see how they are divided. Just about half of them want Camera Trails to stick entirely to the problems involved in the making of the exposure for various types of Nature pictures, and the other half find the more general photographic subjects of greater interest. So in the attempt to make Camera Trails of the greatest possible value to the greatest number of its readers, the plan is to balance the space we have as evenly as we can between the technical problems that apply to any kind of photographic work, and those likely to be encountered in strictly "Nature" picture making. Where a question is of real general interest, its answer will sooner or later be found in these columns, but in any event, whether your question and its answer will help your companion photographers or not, you will receive what information we can supply at the earliest possible moment.

This month, after the announcement of the January winners of the Camera Trails Contest, we'll go into several questions that have been asked most frequently, and we plan to devote an occasional issue to such questions as they accumulate.

The entries as a whole indicate that we have more ability as naturalists than as photographers. The subject matter is of wide variety and the approach to the picture making shows a fine knowledge of how such things ought to be recorded, but in many cases the photographic quality is not of the same high standard.

The winning pictures are "Belted Kingfisher" by A. Haak, Norwood, Manitoba, Canada, and "Have You Heard This One?" by Kinsman E. Crumb, Lakeland, Florida. Honorable Mention goes to George F. Jackson of Evansville, Indiana, Mrs. D. L. Norris of New York City, and M. E. Blaisdell of Goffstown, New Hampshire. Some of these pictures will be published later when space permits.

Congratulations to the two winners! They have chosen a book from the list in "This and That". And to them and the makers of the honorable mention pictures, may you soon make more and even better shots that will add to your libraries! Remember that no entry blanks are needed. To enter your pictures, simply mail them to Norris W. Harkness, 320 East 42nd Street, New York, N. Y. Those received before January 15 will be entered in the March contest.

And now for those questions. The one asked most often is for a definite technique of negative development. There are two ways of developing films—in a tray and in a tank. The tray method is good for larger films that will not be greatly enlarged, but is impractical for most of us if we plan to make big pictures from them. It requires three trays—the first holding the developer, the second for the rinse, and the third for the hypo or fixing bath. Since we must develop the fast modern films in absolute darkness, we should always arrange the trays in the same order to avoid putting the film in the wrong bath first. If we are using cut films or film-pack, we should have a developer tray rather larger than the film size and place not more than four films in the developer at once. They must be moved about rapidly when they first go into the solution to avoid their sticking together and developing unevenly, but after the first minute or two and when they are thoroughly wet, we can agitate them by rocking the tray until the necessary time is up. I usually place the first and third films "east and west" and the second and fourth "north and south". Then, when the tray is rocked, each film moves freely and apart from its neighbor, and the development is even. From the information that came with either the film or the developer I know the time to develop the film at the temperature of the developer, and I often have someone outside the darkroom call to me when the time is up. Then the films are rinsed in the middle tray for a few seconds and placed in the fixing bath, where they are agitated for the first two minutes just as they were in the developer. After they have been in the hypo for fifteen minutes, with an occasional moving about to insure complete fixation, they are washed for half an hour in running water. The films lie face down in the tray and the water runs gently into one end and out the other. Every three or four minutes the bottom film is slipped out and placed on the top of the pile. Then they are hung in a clean place away from the heat and wiped off carefully with a bit of cotton, or, preferably, a viscose sponge.

To develop roll film in a tray involves exactly the same procedure except for one step and the method of agitation. The different step is this. Since the dry film curls badly, it is placed in the clean rinse bath before it goes into the developer and allowed to get thoroughly wet before the development is attempted. It is held by the ends with the emulsion side down and passed back and forth with a see-saw motion for a minute or two. Then the same motion is continued with the film passing back and forth through the developer until the necessary time has elapsed. Then it goes back into the rinse, and thence into the hypo. The motion must be as even as possible and the whole swing should take three or four seconds. The tough part of this method is that we have to continue the see-saw all through the development and for the first three or four minutes in the hypo. Then we can allow the film to

oll up slowly, being sure it is completely overed all the time, and only run it through he bath again from time to time. Again, in he washing we must be sure that every part f the emulsion gets attention, and when the hemicals are washed out, we wipe the film ff with the sponge and hang it to dry.

But our smaller films, which will be greatly enlarged, must be developed in the so-alled "fine-grain" developers that usually eed a rather long developing time. For these tank is far easier and will probably result n more evenly developed negatives. Tanks re now low in price and one is a splendid nvestment for any photographer who is even little serious in his work. They have the dded advantage of needing a darkroom only while the film is actually being put into the ank for all the rest of the process may be arried out in ordinary light.

The steps of tank development are these: Put the film into the reel that holds it and place the reel in the tank in the dark; determine the exact temperature of the developer nd from the chart or table you received with he developer note the correct time the development takes; pour the solution into he tank and then agitate the tank (this must e done carefully and accurately). The notion need not be violent, but it must be nough to displace any air bubbles from the urface of the film, and it must be continued ccording to a definite method. If you wish to gitate the tank for ten seconds of each inute, or of each two minutes, or perhaps ontinuously throughout the whole time, do o, but establish a definite method and stick o it with every roll developed. The amount f agitation changes the time required, so we eed to agitate every roll the same way if we re to get uniform results.

Then, after the development is complete, our out the solution and pour in the rinse ath. Whether this will be plain water or ome special bath will depend on the developer used and we should follow the instructions that came with it. When this bath has een poured out, the hypo goes in and the gitation needs to be rather strong for the rst two minutes. An occasional shake will uffice for the remainder of the fifteen minutes the film stays in the hypo, and the film is hen washed. If a hose is attached to the pigot and the water runs into the center of he tank and out at the sides, twenty minutes washing will be enough. If the quantity of ater used is important, fill the tank with lean water, shake it gently, and leave it for wo minutes. Then shake the reel until it no onger drips, refill the tank with clean water, nd repeat for another two minutes. When his has been continued for eight changes, the ilm is ready to sponge off and to dry.

A further advantage to the Nature photographer lies with the tank method. With a ight-proof changing bag he can load the film nto his tank anywhere he may happen to be, nd he can develop his negatives in the field vithout danger of spoiling them.

But one thing we must keep in mind. The nore uniform our negatives are, the better he pictures we can make. It is vitally important, then, that we establish a definite working method in which we do each step in exctly the same way every time.

The next most frequent question is "What vill a sunshade do for my pictures?" While ve know that our camera includes only a imited part of the scene before us on the egative, yet the light from bright objects just

(Continued on page 57)

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Bush Tit
Verdin
W. Golden-crowned Kinglet
Western Bluebird

7—COMMON EASTERN BIRDS OF TWENTY-ONE FAMILIES

Black Duck
Woodcock
Mourning Dove
Red-shouldered Hawk
Yellow-billed Cuckoo
Flicker
Nighthawk
Ruby-throated Hummingbird
Kingbird
Starling
Bobolink
Orchard Oriole
Song Sparrow
Rose-breasted Grosbeak
Scarlet Tanager
Tree Swallow
Cedar Waxwing
Maryland Yellow-throat
Brown Thrasher
House Wren
Brown Creeper
Tufted Titmouse
Wood Thrush
Bluebird

8—BIRDS OF TWELVE FAMILIES USEFUL TO FORESTS

Hairy Woodpecker
Downy Woodpecker
Pileated Woodpecker
Red-headed Woodpecker
California Woodpecker
Lewis Woodpecker
Red-bellied Woodpecker
Flicker
Yellow-billed Cuckoo
Whippoorwill
Blue Jay
Bullock Oriole
Orchard Oriole
Louisiana Tanager
Warbling Vireo
Maryland Yellow-throat
Brown Creeper
White-breasted Nuthatch
Tufted Titmouse
Oregon Chickadee
Chestnut-backed Chickadee
Bush Tit
Verdin
W. Golden-crowned Kinglet

9—ELEVEN INSECTS; BIRDS EATING SOME OF THEM

Cecropia Moth
Luna Moth
Tiger Swallow-tail Butterfly
Katydid
Cricket
Locust
Bumblebee
Paper Hornet
Dronefly
Giant Crane Fly
Dragon Fly
Whippoorwill
Scissor-tailed Flycatcher
Kingbird
Cassin Kingbird
Vermilion Flycatcher
Mockingbird
Catbird
Brown Thrasher
California Thrasher
Canyon Wren
Seattle Wren
Western Winter Wren
House Wren

10—NORTH AMERICAN BIRDS OF FIVE FAMILIES

Hairy Woodpecker
Downy Woodpecker
Pileated Woodpecker
Red-headed Woodpecker
California Woodpecker
Lewis Woodpecker
Red-bellied Woodpecker
Flicker
Scissor-tailed Flycatcher
Kingbird
Cassin Kingbird
Vermilion Flycatcher
House or English Sparrow
Snow Bunting
Vesper Sparrow
Tree Sparrow
Chipping Sparrow
Song Sparrow
Mockingbird
Catbird
Brown Thrasher
California Thrasher
Bluebird
Western Bluebird

11—COMMON AMERICAN BIRDS WITH SPECIAL FOOD HABITS

Woodcock
Ruddy Turnstone
Mourning Dove
Rough-legged Hawk
Osprey or Fish Hawk
Road-runner
Pileated Woodpecker
Flicker
Whippoorwill
Nighthawk
Starling
Bobolink
Western Evening Grosbeak
Crossbill
Oregon Towhee
Cardinal
Warbling Vireo
Water Ouzel
Mockingbird
Western Winter Wren
Brown Creeper
Oregon Chickadee
W. Golden-crowned Kinglet
Western Bluebird

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A NATION UNITED BY TELEPHONE

JUST twenty-five years ago, on January 25, 1915, the first transcontinental telephone call was made. East and West were united in dramatic ceremony.

President Wilson talked from the White House across the country, testifying to the nation's pride "that this vital cord should have been stretched across America as a sample of our energy and enterprise."

The inventor of the telephone, Alexander Graham Bell, in New York, repeated across the continent to San Francisco the first words ever heard over a telephone—"Mr. Watson, come here, I want you"—to the same Thomas A. Watson who had heard them in the garret workshop in Boston in 1876.

That ceremony ushered in transcontinental service twenty-five years ago. At that time it cost $20.70 to call San Francisco from New York. Now it costs $6.50 for a station-to-station call and only $4.25 after seven in the evening and all day Sunday.

In 1915 it took about half an hour, on the average, to make a connection. Now most calls are put through without hanging up.

These are measures of progress in the never-ending effort of the Bell System to give faster, clearer, more useful and courteous service to the people of the United States.

. . .

BELL TELEPHONE SYSTEM

Indoors and Out

By HOWARD ZAHNISER

WHEN ONE sits in an armchair in a heated house in January it may seem that the world of green things is something far away, long ago, or off in the future. It takes a reminder to make one realize then that the shelter one has, the warmth one enjoys, and the very nourishment that keeps the red blood pulsing through one's animal veins are all the results of the sun rays, which have been marvelously transformed and stored up by those our partners of life that have chlorophyll, "leaf-green", that magic substance that gives the earth its green mantle. With the winter solstice past, men have always found some sort of reassurance in the lengthening hours of sunlight and the associated anticipations of spring—spring, the return of greenness. Neither subjectively nor objectively are we ever far from the influences of the flowering earth, and I have never known anyone who failed to appreciate a reminder that brings these influences above the level of consciousness.

Two such reminders, similar but different, duplicating but complementing each other, are at hand in Sydney Mangham's *Earth's Green Mantle* (The Macmillan Co., $3.50) and Donald Culross Peattie's *Flowering Earth* (G. P. Putnam's Sons, $2.50). In canvas-colored bindings they even look much alike as they stand on the shelf, only the red letters on the back of *Flowering Earth* and the green words on *Earth's Green Mantle* distinguishing them from a distance. Both, on recollection, suggest to the reader the wealth of information that plant scientists have revealed, and both touch the emotions with an esthetic wonder at the marvelous and devious ways in which life has made itself manifest. Both carry the reader through the long millions of years through which the protoplasm of earth has evolved. A New Year's celebration may, after all, be only a trivial affair, but both these books also encourage a faith that the earth will revolve through a great many more Januarys toward an inconceivable number of green spring-times.

Despite these strikingly similar impressions on at least one reader, there could hardly be two books more easily discussed in terms of contrast than these masterpieces by Donald Culross Peattie, an American prose-poet with Nature for a theme, and Dr. Sydney Mangham, professor of botany in University College, Southampton, England. One author seduces the reader into a great deal of self-education with a jacket testimonial that says of his book, "all the things that would make it thorough and dull, I have tried to leave out. . . . If anyone learns botany out of it, it will be by the way." The other introduces a pleasantly strenuous part of his volume with an apology quoted from Gilbert and Sullivan, and concludes it by saying: "If at this point the reader should feel that the last few chapters have called for rather more effort than he had been led to expect at the beginning of the book, let him pause for a few moments to reflect upon the magnitude of the labours of all those who have fashioned this science of plants; his own recent efforts will at least have enabled him the better to realize the significance of plant studies."

Mr. Peattie says in his book's first sentence: "There is morning light here, shafting down through the live-oaks in smoky beams." Dr. Mangham writes an introduction, beginning as follows: "If some mysterious catastrophe were suddenly to annihilate all plant life without harming any animals, man would rapidly come to realize the true significance of plants in human affairs. This book provides a less painful method of gaining such a realization!" These differing overtures sound true keynotes of all that each writes and indeed of the entire volumes. *Earth's Green Mantle* includes forty-two text figures of graphic aids to understanding and dozens of photographs from world-wide sources crowded into forty-one plates, while *Flowering Earth* has seven symbolic wood engravings by Paul Landacre pleasingly appropriate to the text in their artistic inspiration and their exuberance. Both books have indexes and bibliographies, Dr. Mangham casually calling his an appendix, but Mr. Peattie taking pains to label his "informal".

Comparisons and contrasts aside, Dr. Mangham's work is an excellent introduction to a knowledge of plant life and an understanding, not of botany in the sense of plant names and classifications, but of the ways in which plants live and of their part in world ecology. *Earth's Green Mantle* contains also an account of man's progressive efforts to discover the secrets of plants and to devise tools with which to carry on these studies. It tells, too, the fascinating story of man's ingenious use of his plant information in practical agriculture and points out some apparent prospects that lie ahead with wise use. It is a masterpiece of lucid writing. Even the results of the most difficult inquiries into the complicated processes of plant living are made clear and understandable, and not only interesting but fascinating—not through omission of difficulties but through a genius for explanation. Surely Dr. Mangham has realized his hope for the reader "that the perusal of these pages will have helped him in some measure towards a greater enjoyment and a fuller understanding of that never-ending source of beauty and interest, the earth's green mantle". I should say his book will do this in *great* measure.

Flowering Earth also deserves attention without comparison, in reality a creative work by one of the outstanding writers in our generation of American literature, a master of a prose that is poetry, and justifies reading for its own sake, and for its author. Perhaps it is an accident that Mr. Peattie chose to express himself in terms of Nature, fortunately of course for us, who are most pleased when our literature deals also with our greatest interests. I think that we can safely speculate that if the author of the eloquent essay on "Chlorophyll: The Sun Trap" in this book had never been carried away by botanical science we would still be reading what he (Continued on page 55)

IN THE POOL IN THE FLORIST'S GARDEN

Two tree-toads, *Hyla albomarginata* on the leaf, *Hyla faber* below, added their chorus to the noise of a big green "bullfrog" in the water. Several of the remarkable nests of *Hyla faber* were found in the pool

NATURE MAGAZINE
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Brazil Bound

With a collector's kit in South America

By DORIS M. COCHRAN

OUTSIDE snow is pushed in graying heaps from the sidewalks. A raw wind hints a blizzard. Yet I can close my eyes and see an exquisite arch of tropical branches against a soft mist; enchanting vistas between gray and green trees; a red bromelia flower like a huge rose nestling against a parasite-covered tree-trunk. Purple petals of quaresma spangle like stardust the brown gravel of the path I follow. The forest drips gently, and, as I emerge from it, the mist billows and rolls in the valley below, while the sun makes a ribbon of silver on the distant Atlantic. It is summer in Brazil . . . come, come, I'm steeping myself in memories! Let us go back to the day in early December when a note was handed to me. It read:

"On or about January 4, you are instructed to proceed from Washington, D. C., to Rio de Janeiro, Brazil, for the purpose of collecting specimens for the United States National Museum."

This was the official dictum that opened the way to a royal adventure! I had one short month in which to prepare my equipment—rubber boots, miner's headlamp, mosquito "dope", minnow traps, boxes of every size and shape, and the thousand and one other items that are essential to even the smallest of natural history collecting enterprises. And my object was to bring back as large a variety of the fauna and flora of southeastern Brazil as I could pack in my big copper tanks filled with innumerable little glass bottles to hold the smaller specimens.

The sailing date rushed at me through the turmoil of packing, and, still in a whirl, I found myself on the boat steaming away from an icy northern January. As the shores slipped farther and farther away, I watched the gulls, which twinkled like silver spangles on the steel-blue bosom of the North River, and wondered when I should see them again.

I had started for Brazil upon the invitation of Dr. Adolpho Lutz, Brazil's most eminent pioneer in research, not only of tropical medicine, but of all forms of tropical biology. His failing eyesight and advanced age had made it impossible for him to complete his monograph on Brazilian frogs, and I was to study them with him, as well as observe and record at first hand some of the remarkable and varied aspects of amphibian life in the tropics.

PHOTOGRAPH BY J. PINTO

THE INSTITUTO OSWALDO CRUZ
This splendid modern building in Moorish style stands on the shores of beautiful Rio de Janeiro Bay

The very day of my arrival in Rio de Janeiro, I accompanied him to his laboratory in the Instituto Oswaldo Cruz, a Moorish building of startling beauty set on one of the hills rising sharply from the sinuous shore of the bay. The institute was founded by the late Dr. Oswaldo Cruz, who was noted for his fine work in fighting all manner of tropical disease. Its members now devote themselves to scientific research of many kinds, and there is a hospital attached to the institute to which travel daily many people of the

poorer classes afflicted with malaria, leprosy, elephantiasis and the other ailments that are the scourge of the tropics.

Night-collecting is the best method of capturing tropical frogs and all other small nocturnal creatures. So at eight o'clock one rainy evening we started out in the Institute's ancient and rattly touring car over the precipitous roads of the surrounding mountains. Our destination was a florist's garden in suburban Santa Alexandrina, set high on the slope leading upward to the peak of Corcovado, where nightly gleams the heroic statue of the Christ illuminated by brilliant flood-lamps. At the end of a bumpy dirt road between high thickets of bamboo, we came to a white wooden gate. As we waited for a leisurely little colored boy to unlock it, I was conscious of a distant metallic drumming sound—now rising, now falling—issuing from the depths of the dark and misty garden. Before we could trace this sound to its source, we must pay a formal call to our host, the florist. The night was rainy and frog voices were coming from all around us through the darkness. I recognized the whirring call of a toad, not unlike those of some species I knew in North America, but there were myriad other strange little peepings and pipings—frogs, or crickets, perhaps—that came from the perfumed orange trees, from the grass and from the crevices of the stone wall over which the pink *Agapanthus* lilies were bowing their heads.

ONE OF THE CARVINGS OF THE LITTLE CRIPPLE

These in the church of St. Francis of Assisi, and others elsewhere in Brazil, are justly famous

The room we entered was a typically Brazilian interior—a great, high-ceilinged, white-plastered room with long open windows, wide wooden boards on the floor, some modernistic furniture of exquisite inlaid woodwork, a funny old piano, probably rusty from the dampness of tropical summers, and an even older gramophone with a horn. On the wall hung a glass-bottomed tray lined with butterflies' wings, an art characteristic of the tourist part of Rio de Janeiro.

Our host, wearing pajamas, took us into his greenhouse, where scores of marvelous begonias decorated the benches, interspersed with Christmas cactuses heavily loaded with pink flowers. Maiden hair ferns occupied every conceivable crevice in the brick wall, and feathery green *Selaginella* paved the dirt floor under the benches. After we had inspected his *Gloxinia* seedlings, which were his special pride and joy, we took leave of our host and went down into his garden. There enchantment began. A hurrying, noisy, small brook dashed down the slope over huge boulders, and our servant, Joachim, went down it with his flashlight to look for frogs. The serrate leaves of a banana tree made a bold pattern against the sky, while wet drops on grass and ferns overhanging the brook caught a thousand little glittering points reflected from some electric lights on the street bordering the garden.

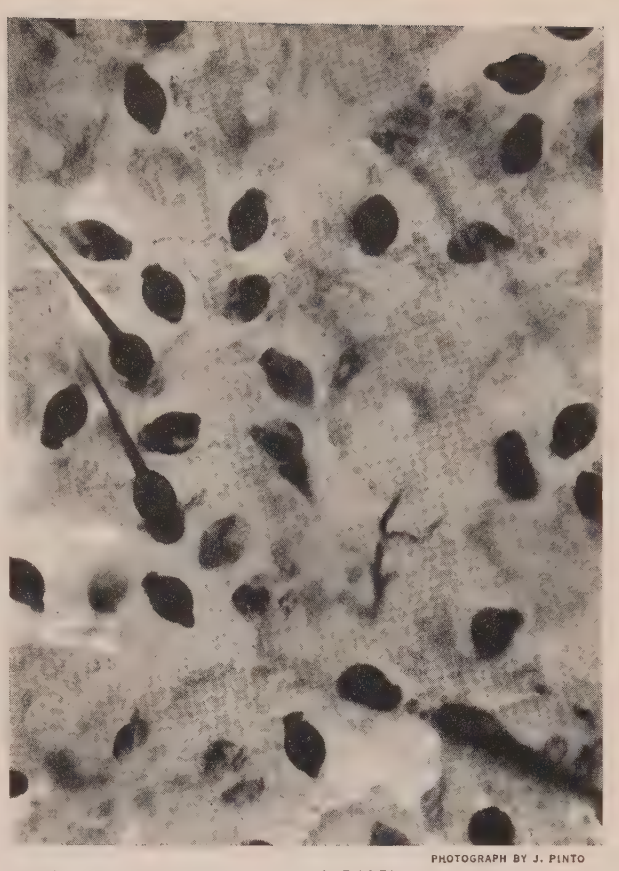
I stood on a rock and looked, surrounded by a kind of luminosity that was not moonlight and not lamplight, but something quite different from anything I had before experienced. I felt as if I were in a theatre with the stage all set for a play, and that in a moment the hero and heroine would step out of the darkness and the play would begin. In a few minutes we saw Joachim's light making a million diamonds shine out in the brook, and he joined us to lead the way to another part of the garden, where artificial pools covered with pink and blue water-lilies gleamed, wet with rain, in the light from our head-lamps. The drumming chorus that I had earlier heard had seemed to come from these pools, but as we approached, it ceased.

Now the real collecting began. Wading first among the shrubs that bordered the biggest pool, I flashed my light into the face of a green tree-toad, *Hyla albomarginata,* with yellow legs and black unwinking eyes, which was clinging to a small orange-tree. Dazzled by the glare, he remained motionless, his little throat partly puffed up for the next note that I had surprised him into forgetting. Safely deposited in my collecting bag, he was soon joined by some of his brothers and sisters, to provide good color notes and observations in the laboratory next day.

Joachim called me to see the nest of the originator of the drumming sound we had first heard—the giant tree-toad, *Hyla faber.* It was a most surprising bit of architecture, fully a foot wide and four inches high, made of mud heaped up and hollowed out crater-fashion, so that the rim of the crater came slightly above the surface of the water. The central depression contained an inch or two of water in which we saw a great mass of frogs' eggs, with the tadpoles already showing up as large black spheres scattered regularly through the jelly. Thus protection from

egg-eating fishes is provided, and by the time the hatching has taken place and the young tadpoles have been washed into the big pool by a heavy rain, they are able to swim and in some degree escape or hide from their numerous destroyers. We saw six or seven similar nests in this little pool, barely fifty feet across, and we took a few of the eggs to be hatched out later in the laboratory. On the last nest, we saw the female frog sitting, clutching the brim with her long disked toes and fingers, and goggling at the light. Such maternal solicitude should be rewarded by continued freedom, so we did not collect her. One more species, the big green "bullfrog", *Leptodactylus ocellatus,* ended our collecting for the night in that lovely, rain-scented tropical garden.

A month later my collecting took me to the State of Minas Geraes, where the Instituto Oswaldo Cruz has a branch at Bello Horizonte. While there we collected at Lagoa Secca, a marvelous dry lake in a valley of iron soil. The road to it changes from yellow ochre mud to dry, powdery, burnt sienna iron dust. The vegetation, too, changes completely from rich green grass to shrubby, dry-loving, leathery-leaved plants and bushes. As we left our automobile a green lizard, *Ameiva,* dashed across the road, and we dug him out from the roots of a purple-flowering wild crêpe myrtle. Walking down a slope through cow-paths that were mostly iron dust, we came to a broad flat field in which little twinkly patches of shallow water gaily reflected the sun. The place was alive with tiny frogs, *Pseudopaludicola ameghini,* skittering about with all the animation of grasshoppers. I went after them, but at first



PHOTOGRAPH BY J. PINTO

EGGS AND TADPOLES OF *HYLA FABER*
These were taken from the crater-like mud nest shown in the frontispiece, and were raised in the laboratory

I got only one in every twenty. The short grass, or sedge, that covers this iron-bottomed marsh is fine and delicate, and forms an admirable cover for these inch-long frogs if they have the sense to sit still. But they seem nervously impelled to jump about every five seconds, and if you can see where they land, you can sometimes seize them before they are off again. Yard-square holes cut into the hard ground to impound drinking-water for the placid white zebus grazing there held deep red water, the color of sassafras tea, and all the tadpoles I caught in them were stained red from the iron content.

The rivers run with gold in Minas Geraes. From the train I saw strange rodent-like tunnels on the sandy shores of the Parahyba, and near them the big wooden sluicing troughs attended by two or three men and boys, who thus took their living from the cloudy waters of the turbulent river. One of the oldest gold mines in Brazil is located at Morro Velho, over a few mountain ranges from Bello Horizonte. This mine has been in operation for more than a century and a quarter, and has now reached the 29th level at a depth of more than 8000 feet. At this depth the temperature is so great—138°F in spite of cold water pumped in to cool the air—that the rich vein, which goes down at a 45° angle, will soon have to be abandoned. I was not allowed to enter the mine shaft, for superstition has it that if either a priest or a woman enters a mineshaft, some terrible disaster will overtake the miners the next day.

We next visited the old town of Ouro Preto—Black Gold—founded 300 years ago by the Bandeirantes, a

BROMELIADS LIKE HUGE ROSES
They held a cupful of water in their leaf axils, and spiders, frogs, ants and arboreal "earthworms" dwelt there

group of Portuguese slave hunters and gold-seekers who came north from São Paulo. There are sixteen important large churches in this ancient village, and one of them is known as the Church of Aleijadinho, or the Little Cripple, named for a victim of leprosy who completed remarkable carvings for its decoration.

Unwillingly taking leave of this ancient edifice, we climbed a street paved with uneven blocks of stone and too steep for any traffic except donkeys, pigs and schoolboys. Along the road leading from the town, huge old stone walls, the remnants of the early Portuguese settlements, loomed here and there, sometimes the mere shells of rooms, sometimes with mud additions and tiled roofs, homes for the poor. Many of the town's larger houses were of variegated hues, perhaps a band of maroon around the bottom, the ground floor painted white, the second story blue, and, often, some green below the roof of dull yellow tile.

MANY SPECIMENS WERE COLLECTED HERE PHOTOGRAPH BY WILLIAM KEMP

The short grass along the shores of this shallow lake was alive with tiny active frogs known by the imposing name of *Pseudopaludicola ameghini*

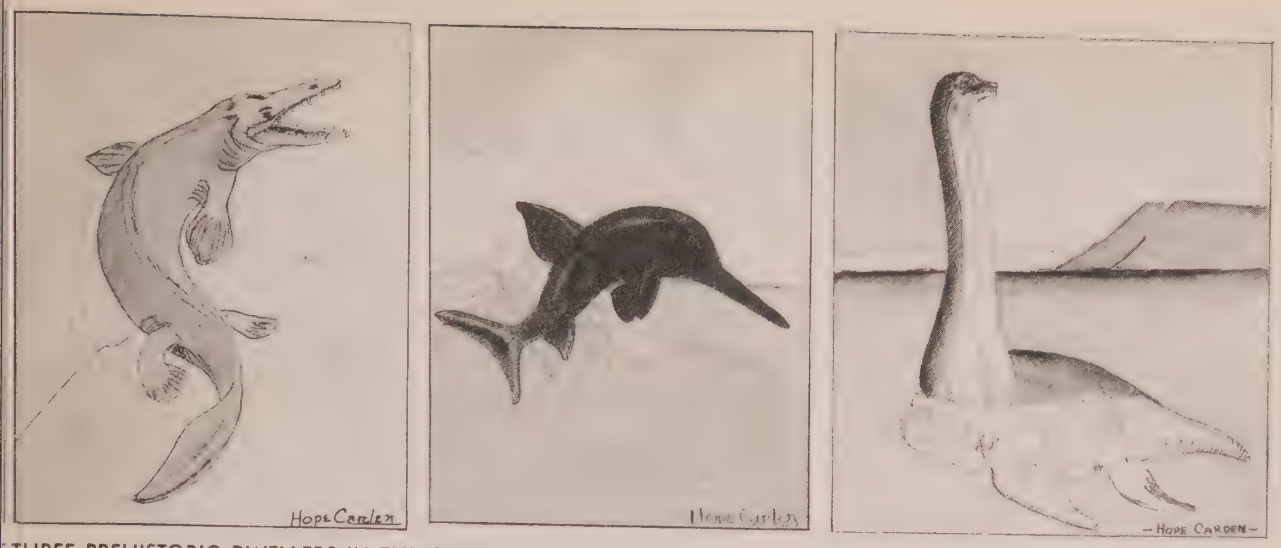
Bat caves, it was said, are located on the mountain-side above the town, possible hiding places for frogs. So we left the good roads and struck up into the mountain on a narrow mule path. On the way we passed many abandoned gold-mining tunnels. Exploring one, my companion led the way with our only flashlight. It is a queer sensation to follow ten feet behind a little dancing disk of light into utter blackness, the walls on each side slimy to the touch, water dripping from every ledge, some of it hitting the back of your neck, the floor uneven and slippery, your feet feeling the way among boulders you can not see, trying to avoid numerous holes in the floor, your head sometimes striking the roof where it suddenly drops, and every effort concentrated on trying not to get too far behind the light. Finally the tunnel heightened, and bats were seen flying about, disturbed by the light. We hit at them with our trimmed tree-branches to stun them as they flew by us, but they skilfully eluded us. On the way back to the entrance, we saw some frogs, *Thoropa miliaris,* hopping about on the floor of the tunnel, and bagged them at once.

Outside in the brilliant sunshine we climbed again, being joined by a negro boy and man, who told us there were ponds and a rivulet containing frogs just a "little ways" farther over the curve of the mountain. As we went higher and higher, the whole valley unrolled before us until it seemed that we were looking over the edge of the world. A host of gorgeous wild flowers decked our path. On the lower reaches, exquisite magenta fuchsia trees held out their pendant buds, while pearly white begonia flowers gleamed everywhere. Purple quaresma trees, with flowers shaped like dogwood blossoms, floated lazy petals down upon our path, and bees worked busily in every chalice. On the higher levels, a rock garden of Nature's own design was blooming profusely everywhere.

On our way up we passed through the abandoned works of the gold mines built by the Bandeirantes more than 200 years ago. Great stone doorways that led to nothing framed exquisite bits of mountain and cloud across the valley. I wished I were an archeologist with pick and shovel, to dig around the old fallen lintels and perhaps unearth rusted locks and keys, or ancient coins, or even old mining tools lying hidden in the earth. Below us in the valley lay a tea plantation, a patchwork of red soil between the rows of cultivated bushes. Now our negro guides led us to a rather steep decline, at the bottom of which a turbulent little stream shouted at its release as it hastened down to the valley. Here we secured some large black tadpoles of the frog called *Phyllomedusa,* but no adults, as they sleep in the daytime in axils of leaves, where it is next to impossible to locate them.

Our next stop was half-way down the mountain at the old mine ruins. We stumbled down a gigantic stairway of solid rock that twisted and twined down the slope, and found the cave, but I was, at the moment, more interested in getting flower seeds. A peculiar trailing vine fell down over the rocks. Its leaves and stem were somewhat like those of wandering jew, but its flowers were closed, like those of a gentian, and of the most heavenly deep blue. A few drops of rain fell, and as we ascended the giant stone staircase it began to come down heavily. We took refuge in a native dwelling constructed between ancient stone walls and roofed over in the crudest manner with a few branches and mud. The place was abominably dark and filthy and I would much rather have stood in the rain.

One more picture—the rain-forest at Alto da Serra near São Paulo—lingers unforgettably in my memory. As we got out of the train, the gray wet mist blanketed the railroad station and the little town (Continued on page 58)



THREE PREHISTORIC DWELLERS IN THE OCEAN

Mosasaur, a vicious reptilian sailor in the Cretaceous seas; ichthyosaur, a great ancient sea reptile; plesiosaur, a notable dweller in the seas of the Jurassic Age

Social Security in the Seas

Nature has given under-water forms means of survival

By FRANCES E. POTTS

Illustrated by Hope Carden

LIFE everywhere is hazardous, and we may think, nowhere more so than in the water. To eat, or not to be eaten, are life's greatest problems in the sea. Here Nature has apparently experimented with more different types of body build, various forms of organs for locomotion, and numerous special devices for self-protection.

In the remote past several groups of sea animals made the greatest adaptations to their watery environment known to man. They rose to a sphere of success and prominence in the Mesozoic seas never excelled, or even equalled. Life on land, for these reptiles, had proved unsuccessful, so they returned to water, where they developed bodily form, strength and agility that made them stand out as perfection in sea-worthiness.

One of these, the plesiosaur, seems to have had everything for security in its environment. Its name immediately gives its family connection, for, interpreting from the Greek, *plesios* means near or like, and *saurus,* reptile. The plesiosaur did have reptile-like characteristics, for the shape of its head and its long neck were like those of the snake, and in the short, stout, broad body, with short tail it somewhat resembled the turtle. Of course the plesiosaur's body often was thirty-five to forty feet long, with twenty to twenty-five feet devoted to neck and head, so one hesitates to compare it seriously with such reptiles as the snake or turtle.

This reptile's head was filled with numerous sharp, flaring teeth, set in distinct sockets, which indicate that the lizard-like animal was thoroughly capable of ruthlessly tearing flesh. The fossil bones and shells found in and around the stomach cavity of the plesiosaur, and the type of teeth it possessed, indicate that it ate small fish, shell animals and pterodactyls, or flying reptiles. It made a most happy adjustment in order, no doubt, not to be bothered about fish bones and shells, by developing an organ to grind them to digestible form. This gizzard-like organ, in some specimens discovered, was filled with approximately a half-bushel of stones from the size of a large walnut to the proportions of a baseball. The round and highly-polished surface of the stones indicate long and hard use in grinding. With such equipment the plesiosaur must surely have enjoyed oysters on the whole-shell.

The long neck characteristic of the plesiosaur had its distinct advantages. It enabled the animal to reach long distances for prey without moving its body, to dive to considerable depths for food and promptly to return to the surface for air. Unlike the giraffe, whose neck grows longer by the elongation of the individual vertebrae, the length of the plesiosaur's neck was increased by the vertebrae becoming more numerous.

The short tail of the plesiosaur seemed to be of little help in swimming and was doubtless used more for steering than for propulsion. For locomotion, however, the four fan-shaped paddles served this reptile well.

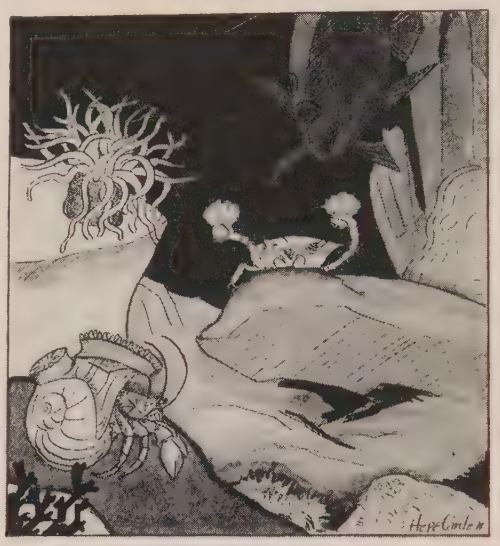
Blessed with all these facilities for procuring food and for avoiding its enemies, one would expect the plesiosaur to have been secure in its environment. But with ruthless finality Nature blotted them out of her picture. Nature rules supreme. Like any queenly power she demands drama on her stage to suit her whim, and when displeased she beheads the struggling actors.

Vying with the plesiosaurs for perfect sea-worthiness

were the ichthyosaurs. In size they were a match for the plesiosaurs, and although they were reptiles, they developed more of a fish-like form than the plesiosaurs. The ichthyosaur swam with a wriggling fish movement and developed a fish-like tail, but never abandoned paddling with its degenerate organs of land locomotion. Through much experimentation Nature seems to have found most successful the fish-like bodily forms.

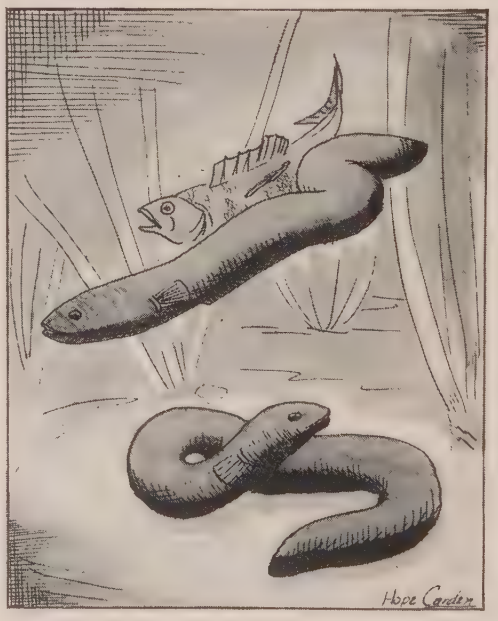
The ichthyosaurs were ambitious. When they left the land for water they ever strove to become fish-like. Not only that, they were successful in leaving behind the reptilian habit of laying eggs and became viviparous. Since they brought forth their young alive, and there were no eggs to be gobbled up, the mortality rate should have been considerably lowered. It seems that with their perfect fish-like fitness for the sea, and their advanced viviparous habit, their kind should have been perpetuated. With apparently all the trump-cards stacked for perfect social security, the ichthyosaurs became extinct for reasons unknown. Nature clothes herself in secrecy.

But the mosasaur was the sea villain in reptilian clothes. It also came from land to try life in the seas. With great size, ferocious appetite, vicious teeth, the speed of a torpedo, superb agility, a jointed jaw that enabled it to swallow prey larger than itself, it achieved sea success and ruled supreme. The mosasaur seemed highly developed in the art of self-preservation and was even more stream-lined than plesiosaur and ichthyosaur. But the species lived a fast life and a short one. It soon sank to extinction.



ANEMONE OF THE SEA

It is well equipped for life, and crabs often use it for their own protection. Below, an electric eel shocks its prey. Fishes used electricity long before man discovered its value



Remarkable, however, is the manner in which the lesser powers of the waters have developed some ingenious methods of self-preservation. These forms of sea life seem to be content to live happily rather than strive for supreme seaworthiness and sub-marine power. Therefore, through their unusual ingenuity, they seem to have arrived at a state of greater peace and ease than some of their more famous brothers of the past.

The flying gurnard leaves the water and soars through the air unbelievable distances if pursued. Interesting is the fact that such a species, by trial and error and through thousands of generations, has developed this manner of avoiding its enemies. This fish seems to be one of Nature's favorites, for she has endowed it with so many talents. Not only does it fly but it walks around on the bottom of the sea. The two ventral fins of the young gurnards are well developed into leg-like appendages on the under side of its body, and these are used for locomotion on the sea-bottom. To achieve aerial success the flying fish must wait until fully grown for the pectoral fins used for flying are not fully developed until then. Because this fish can fly, swim, float, and walk, man does not know whether to accuse Nature of favoritism or of experimentation.

The porcupine fish has acquired an effective method of protection. It is covered with sharp spines that lie close to the body until the fish inflates itself with air or water. Then these spines are erected. Because of this fact the porcupine of the sea is often called a burr-fish. Inflated, this fish is carried hither and thither by wind and wave. Being globular, and bobbing in the water like a floating ball, the porcupine fish is not easily preyed upon. If caught, it is swallowed with difficulty.

The fearless sharks are known more often than other fish to swallow the porcupine fish, but many times to their grief and ultimate death. While imprisoned in the shark's stomach the porcupine fish gives off a red secretion, which is thought to render the digestive juices ineffective on the prisoner, giving it a chance to chew or gnaw its way out.

The fish that seems to have arrived at perfection in achieving a life of peace and ease is the shark sucker, *Echeneis naucrates*. By means of a sucking disc on top of its head it attaches itself with a powerful grip to larger fishes, turtles, whales, even ships. It prefers sharks, however, which accounts for the name. When this hitch-hiker of the sea wishes to go places and see things he does not have to resort to "thumbing" but attaches himself to the speediest fish and apparently gets the maximum enjoyment out of life by assuming the minimum in responsibility. In brief, the sucking fish has sacrificed independence, and, to a certain extent, its ability to swim. In their place it gets security.

Not only is the sucking fish dependent upon others for

locomotion, but it has stooped so low as to be satisfied with the crumbs from its host's table. In its strategic position underneath the shark's body, it catches portions of food discarded or dropped by its host, thus making it a hitch-hiker supreme.

Fishermen have taken advantage of the ability of the shark sucker by tying a cord to its tail, throwing it into the water, and waiting for it to attach itself to a choice fish. The sucking fish has been known to lift, by means of the disc on its head, as much as twenty-five pounds.

Nature must have been in a whimsical mood when she decided to bestow some special honor upon one species of the animal kingdom and adorn it in the likeness of a beautiful flower. In the sea kingdom the anemone plays an unimportant role, but its beauty makes up for its insignificance. For whatever purpose it evolved its beautiful forms and colors, its self-protection or camouflage ranks high in degree of water security.

DRAMA IN THE DEEP

A shark with sucker fish attached tries to catch a flying fish. Below, jellyfish and Portuguese man-of-war (on surface), both well equipped for the uncertainties of life in the ocean waters

The organs that appear as petals of the flower-like animal secrete poison with which the creature stuns small fishes, crabs, shrimps, or sea urchins when they venture near. These petal-arms then slowly draw the paralyzed victim toward the center mouth. Just below the mouth the stomach, or gullet, envelops the helpless prey. In a fashion certainly not recommended by Emily Post the sea anemone ejects any hard or indigestible portions of the crustaceans, after they have remained in its gullet until the softer parts have been dissolved, by thrusting its gullet right up through its mouth.

Although this animal does not have speed of movement, agility, tail or fins for locomotion, or great size to serve as protection, it enjoys quite a successful type of security in its environment. Nature has allowed it all the privileges and essentials. It lives, grows, reproduces, is well fed, and is able to protect itself against enemies.

So successful has the sea-anemone become in self-protection that certain crabs put them upon their backs, or carry them in their claws, to ward off crabby dangers. This act on the part of the crab is also beneficial to the sea-anemone, for, as slow as are the crustaceans, they move speedily in comparison to the parasite. This gives the anemone greater chances for procuring food, and, perchance, a more varied diet. The hermit crabs know the anemone's ability and cheerfully exchange drayage for protection. Anemones have lived in the seas for millions of years.

Lowly, but enjoying remarkable security, are the jellyfishes. They live, eat, grow, reproduce, navigate, and yet have no brain, no lungs or gills, no skeleton or kidneys, no heart or blood. In fact they are mostly jelly, nerves and poison. Their greatest charm, however, is in their possession of something akin, in action at least, to phosphorus, which causes them to glow at night on the surface of the water. Ever trailing behind the jellyfish are numerous tentacles, sometimes even reaching a hundred feet in length, equipped with poison for stunning little fishes and drawing them into the center to a crude mouth and gullet. Jellyfishes, in their simplicity, are sublimely unconscious of the fact that they have held their rank and place in the sea kingdom since Cambrian time—hundreds of millions of years.

This tentacle-method of protection is used most effectively by the Portuguese man-of-war. Aside from its array of tentacles, this animal consists merely of an air-bladder body, tinted with Nature's most delicate colors. It is continually tossed about by wind and wave. The mass of thready-looking tentacles make the lowly jellyfishes and Portuguese man-of-war self-sustaining and thoroughly capable of self-protection.

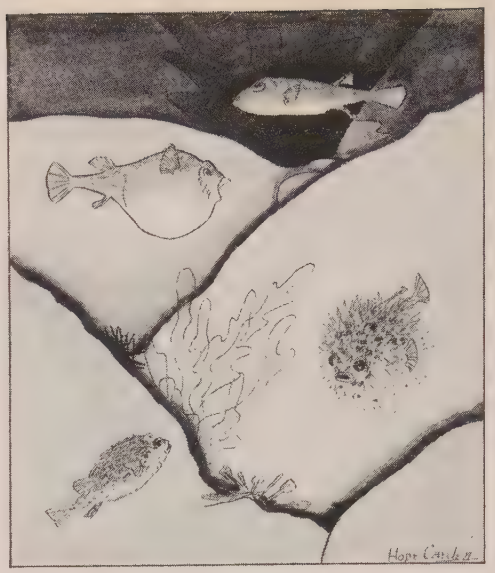
Long before man harnessed electricity and made it serve him, fish were using it for protection, and to attract or stun their prey. Of the numerous fishes resorting to this method, an eel, or eel-like fish that inhabits the rivers of Brazil, seems most successful. It has the most powerful electric dynamo of all fishes.

Because of its similarity of form, this fish is referred to as an eel. Two rows of "electric cells" extend the entire length of the body and are capable of producing 200 to 300 volts of electricity. Contrary to most electric fishes this species seems to have an indeterminate amount of electricity for it can produce such a voltage hundreds of times before the supply is diminished. With such potentialities the electric eel must surely enjoy security.

While the electric eels seem to be the most powerful "shockers" of all the fishes thus equipped, the same power is possessed in some degree by several other groups of fishes, including a fresh-water catfish found in Africa,

the star-gazer of the Gulf of Mexico and adjacent waters, the torpedoes of warm oceans, and several other species of skates and rays that are widespread in tropical and temperate seas. The source of the electric power is variously situated in these different groups of fishes. In some it occurs near the bases of the pectoral fins, and in others on each side near the terminal parts of the tail. There are many questions regarding the origin, development and uses of this power yet to be answered.

Scientists are inclined to believe that the earth's age is more than 2,000,000,000 years; that protoplasm has been struggling against enemies, overcoming its environment, and seeking security, for a mere 500,000,000 years. During that time life has tried various body builds, different organs of propulsion and devices for protection, to develop a creature that may enjoy security in an eat-or-be-eaten environment. The great plesiosaurs, ichthyosaurs, and mosasaurs survived approximately fifty million years, while some of the lowly kinds of life, with more ingenious forms, lived five hundred million or more years.



PUFFER AND PORCUPINE FISHES
Their ability to inflate with air or water provides them with a unique protective device

It is difficult to determine whether Nature expects of her sea creatures sea worthiness and short life history, or the ingenious adaptation to environment of the more lowly creatures of the seas.

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WILLIAM M. RUSH

A thumbnail sketch of the experiences of the author of the special conservation insert appearing on pages 29 to 36 of this issue.

Since 1910, when he first became interested in wildlife non-professionally, Mr. Rush has been on nearly all of the important big game ranges in the United States.

His first professional job was in 1913 when he was detailed by the Forest Service to study elk on the Absaroka National Forest in Montana in connection with the Yellowstone Park elk problem. For several years after the World War he was on the Lewis and Clark forest in Montana concerned with the Sun River elk problem. Next he made wildlife studies for the Park Service in Yellowstone National Park, first on detached service, later in cooperation with the Forest Service and the Montana State Game Department. After this he was wildlife specialist with the Forest Service for several years, and then was with the Biological Survey as Regional Director in the Pacific Coast region, a position which he resigned in the spring of 1939. Mr. Rush estimates that during the past twenty-eight years he has read 31,000 reports on wildlife subjects by 9100 authors. He has travelled 69,000 miles by airplane; 179,000, by train; 972,000, by automobile; 42,000, on horseback; 14,000, on snowshoes, and has walked with pack on back at least 19,000 miles more. Travel by airplane, rail and automobile has been largely to and from attendance on 10,942 wildlife meetings and conventions.

He has worn out four Model T Fords, two Dodges, and one Pontiac, and has contributed toward the retirement of half a dozen other motor vehicles. Dozens of saddle horses grew old and died in his service. Snowshoes came from Norway, Maine,—good ones, too, but he used up a dozen pairs. Footwear beyond count ranging from moosehide moccasins to classy riding boots were destroyed in following the highways and byways of elk, deer, bears, coyotes and other wild creatures, and, incidentally, one fairly good physique has been pretty well whipped out.

He has counted wild animals from snowshoes, horseback and airplane; given elk, deer and bear medicine by os, intravenously and sub-cutaneously; taken blood samples from them; counted their white corpuscles; made cultures from their lesions; and has even sold tape worms from black bears to a biological supply house for seventy-five cents apiece, and scab mites from mountain sheep for twenty-five cents a dozen, to buy more laboratory equipment. One of these was located in a basement so cold that it took hard exercises to keep him warm between periods of peering through a microscope at strange bugs. He has shoveled out wilderness cabins when the snow was eighteen feet deep to get to the bed and grub he hoped would be there, dug his car out of the sands of Lower California, and toasted in a temperature of 117 on lower Colorado, looking for duck ponds.

Whether he was watching wild hogs in Florida, antelope in Arizona, goats in Montana, or bears in Yellowstone, he found all the work interesting. The most puzzling thing about it all, he says, is: "How could I live so long, have such wonderful opportunities, and emerge knowing so little about wildlife?"

JERRY WAS TAKEN TO THE PHOTOGRAPHER

Because he was hungry he was willing to pose and eat at the same time, but when he had gotten all he wanted he flew about the studio and only granted one final pose on a head of cabbage

JERRY WAS A GROSBEAK

He ate and grew and finally flew away

By MARIETTA MOORE

Photographs by J. W. McNees

On JULY 7 we first saw Jerry. He was a tiny ball of black and white feathers with a bobbed-off tail and rose-tipped under wing coverts. He was sitting on some croquet arches that leaned against an elm tree. He was quite unfrightened so long as we made no move to capture him. We had no such designs, of course, because we had seen the grosbeaks nesting in our elm, and supposed that they would soon come with food. The youngster sat on the wickets until the pup next door scared him into some protecting bushes.

To give his beautiful rose-breasted father and his sparrow-like mother a chance to bring breakfast, we retreated to the house. The rest of the morning the bird hopped about the yard unattended, and, by noon, had somehow reached the relative safety of a small branch in a fairly high tree. By now, too, he was hungry, and began to call with a weak little cry. As he got hungrier and hungrier, he cried louder and louder. Should we take him into the house and give him something to eat? All afternoon we listened and kept watch for the parents, being careful not to go close to the young bird for fear of frightening them away. They never came.

That night it was plain that something had to be done about the hungry orphan. His cries were piteous. A boy with an airgun, a hawk, or some other unkind fate, must have left us with a ravenous orphan bird. So, while he squawked loudly, we took him from his tree.

What diet was now the question. We tried to coax him to take milk from a medicine dropper. It was none too successful, and he took little milk, but finally stopped crying and seemed contented.

My caterpillar cage, cleaned out and supplied with some short branches, provided a home. When we first put him in he was restless, but soon settled down and tucked his head under his wing. He had had a long, hard day in the big lonesome world.

JERRY ON HIS BRANCH

This was brought into the house and the bird accepted it as his tree, spending much time on it

Early the next morning we were awakened by his calls of hunger. He was timid when we first picked him up, but suddenly discovered that there was something good in the medicine dropper we were holding over his big bill, so he opened his mouth and drank it greedily. As he ate, he made a crying sound, finally closing his mouth. When we put him back in the cage, he immediately went to sleep, and we went back to bed. Thirty minutes later he was hungry again, and said so. This time we gave him some of our canary's egg biscuit

along with the milk, and gave up sleep to stay up and feed him whenever he called.

A family conference was held on grosbeak diet, and was adjourned to our bird books, where we found that their food included wasps, flies, grubs and potato beetles.

First we caught flies for Jerry—by then he had been named and christened with milk. We tried to dig for grubs, but the ground was hard and dry from lack of rain and we found only three. Jerry thought these a real treat. Not knowing what would be the best substitute for grubs and the like, I turned to my *Nature Magazine* files, for I remembered having read articles about people who had cared for orphaned birds. I found that steak and liver, instead of worms, bread crumbs, berries and lettuce had proved successful. We began giving Jerry these things, along with cabbage, carrots, potatoes, macaroni and suet. This diet seemed to satisfy him.

WATER BETWEEN BITES OF FOOD

He was fond of water, inside and out, and seemed to want to drink between every mouthful at meal time

In the meantime Jerry had become restless in the cage, and we realized that a wild bird that had started its life in a big open tree should not be kept in confinement. So we brought a branch into the house for him to sit on, placing it in an open window on the shady side of the house. When we put him on it, he was quite at home, hopping about on the various twigs for a few minutes, and then going to sleep. All day he slept on his branch, waking up only to be fed every half-hour.

The next six days of Jerry's life were similarly spent. Each morning he woke us early, crying for breakfast, and, of course, kept this up all day when he was not asleep. While Jerry slept, we were kept busy trying to dig earthworms in the sun-baked garden. One day Jerry ate fifteen earthworms and one hundred flies. The next day he ate fifty worms.

Each morning Jerry was given a bath under the faucet, and then hopped about the house a while before going to his branch. He was fond of water, and seemed to like a drink between mouthfuls of food.

During the next five days, he slept less and flew about the house quite a bit. He usually landed on a chandelier, and from there watched us hunt for him with indifference.

One day he learned by himself to take a bath. I had been trying to teach him to drink. He had been playing with a toothpick, and I took it away from him and put it in a little glass dish of water. I was hoping that, trying to get the toothpick out of the water, he would get some water in his mouth. Instead, Jerry discovered that the water splashed, and forgetting all about the toothpick he jumped in and took a good bath. I gave up the drinking lesson, for I thought Jerry had learned enough for one day. However, the next day he learned to drink water, and also to pick up crawling flies and ants.

That morning we took him out to the bird bath, and he seemed to enjoy splashing about in it. After his bath, he sat on my finger while he sunned and preened his feathers. Then he suddenly took off to a nearby tree. We did not think he would be able to take care of himself yet, so we brought him back into the house.

During the next two days Jerry became more independent. He flew about the house without bumping into the walls, and sat about on the doors, on the piano, on the chandeliers, or wherever he took a notion to alight. But still, when he got hungry, he would call and flutter his wings with impatience. One day, when I was practicing on the piano, I did not hear him call, and he flew into the room and landed on my shoulder, demanding his dinner.

We now took Jerry out of doors for his bath every day, after which he always flew to a nearby tree. However, we always succeeded in getting him again since he had not flown far because his feathers were so wet. Then one morning we had company, and in order to show our pet off, we took him out to the bird bath to take a bath. But instead of taking his bath, Jerry decided that it would be a good time to leave. No coaxing could persuade him to come down. We were worried for fear he would starve to death, but later in the morning he commenced to get hungry and began to cry from the tree top. We went out and called to him and he flew down and circled about the yard, finally alighting on my shoulder. I thought that our troubles were over, but before I could give him anything to eat, he was gone again. I was sure that if he got very hungry he would come down to us, and he did, about an hour later. He would not come into the house, however, but took a hurried lunch on the back porch.

He spent that afternoon visiting the various trees in

the yard. He took a bath of his own accord, and he seemed to be having the time of his life. Whenever he got hungry he would call to us, and, when we answered, he would fly down to the shoulder of the one nearest him, or to the porch rail. He would then come into the house and eat, and be off again. That night he stayed in the house, but early in the morning we let him go. He stayed out all that day, all night, and the next day until noon, coming in only for food at regular intervals.

The temperature at noon was 105°. Usually after Jerry was fed, he would get a wild look in his eye, and would stand up tall looking for some tree to fly to. But this time he had no such look, for he had found the trees unbearably hot and the pan in the kitchen sink, where he had just had a bath, comfortingly cool. So there he sat for more than an hour. Then he hopped out and flew to the round of a kitchen chair and sat there all afternoon. When evening came, Jerry was ready to travel on. After eating some flies, hard boiled egg and corn bread, he flew away.

During the next few days Jerry continued to come and go about every two hours. Each day he went farther away, and came home less often. At noon, when it was the hottest, he often stayed in for a while and took a nap on top of a door.

One day when Jerry came for something to eat, another little grosbeak, exactly like him, came along. Jerry went into the house to eat, and the other little bird stayed out on an overhanging branch on the porch. We held some food up to him but he could not quite muster up enough courage to come down and get it, although he looked eager.

About this time we began to notice that Jerry was becoming more impatient when he wanted food. He came much less often and was in a great hurry to get away. Each morning he came later and one day not until six-thirty in the evening. He did not seem as hungry, and we noticed that his bill was often stained from berries. Once we saw a little dirt on it. On August 4 he was a wild, independent bird in contrast to the helpless ball of feathers we had found on July 7.

Jerry had never sat for a picture, so we decided to take him to the photographer. We knew that if we were to get any pictures, we would have to take him hungry. So the next morning when he came down, we gave him nothing to eat, but took him to the studio. It took almost an hour and a half to get the pictures. The first ones were easy for Jerry was so hungry, but as he began to get filled up, he commenced to fly about. We finally caught him for one last picture—on a head of cabbage. After this one was taken, we took him home, but by then he had no desire to go outdoors. Instead, he sat on the top of a door and went to sleep. Having one's picture taken is indeed an arduous task!

From then on we saw less and less of Jerry. He came late, or maybe not at all, and when he did come it was only just long enough to snatch a bite. August 14 was the last day we saw him, and that day he stayed about an hour after the noon meal. That evening he flew away.

The next year we again had a pair of grosbeaks nesting in one of our trees. The male was unusually tame and would sit on one of the lowest branches of an elm tree and sing while we were in the yard, scarcely three feet below him. Later, when his young were out of the nest, he seemed to have no fear when we were around in the yard near them. But the female did not like it a bit, and she never came near us. Of course we have no proof that this bird was actually our bird, but we like to think that he was.

Monarch of the Wilds

By EDITH M. LAING

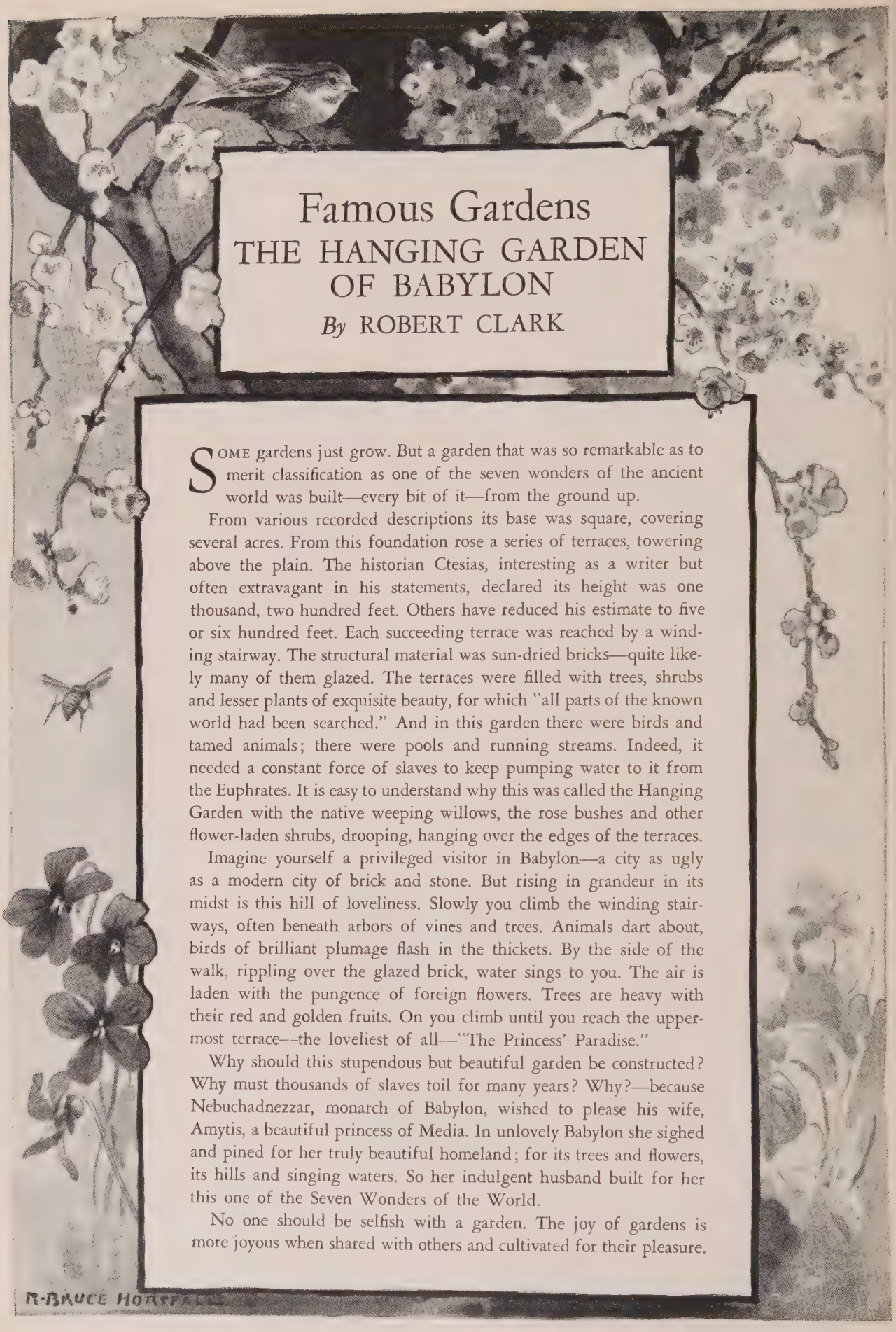
THE NOBLE animal pictured and named on one of Newfoundland's stamps as "Monarch of the Wilds" is surely worthy of such a title, for the caribou is a notable example of triumph over inhospitable regions.

The caribou are members of the deer family (Cervidae) and resemble the domesticated reindeer of Lapland. It is thought that they are descended from reindeer, which, in ages past, reached this continent by way of the Bering ice or land bridge.

The caribou's great antlers are strikingly branched and are worn by the female as well as the male. Its hoofs are specially adapted for travelling over snowfield and muskeg. The coat, which varies from dark brown to light gray, is thickly felted to repel the winter winds and icy sleet.

American caribou range from the lower Canadian border as far north as land extends, and belong to two main groups: barren ground and woodland. The former, as the name indicates, roam the desolate treeless wastes of the far north, feeding on grasses and sedges in summer and lichens in the winter. At one time countless thousands of these were reported by amazed witnesses of their annual migrations, but the numbers have lately been much reduced by hunting.

The Newfoundland caribou belongs to the woodland group. Like the other related caribou of Nova Scotia, New Brunswick, Quebec, Ontario and Manitoba, it ranges over both forests and muskegs. It annually migrates from the north to the south of the island and until 1924 its shooting was allowed for more than four months in fall and winter. This long season was followed by seven years of protection from shooting. We hope that this fine animal has been able to recoup its numbers, but records are scanty.



Famous Gardens
THE HANGING GARDEN OF BABYLON

By ROBERT CLARK

SOME gardens just grow. But a garden that was so remarkable as to merit classification as one of the seven wonders of the ancient world was built—every bit of it—from the ground up.

From various recorded descriptions its base was square, covering several acres. From this foundation rose a series of terraces, towering above the plain. The historian Ctesias, interesting as a writer but often extravagant in his statements, declared its height was one thousand, two hundred feet. Others have reduced his estimate to five or six hundred feet. Each succeeding terrace was reached by a winding stairway. The structural material was sun-dried bricks—quite likely many of them glazed. The terraces were filled with trees, shrubs and lesser plants of exquisite beauty, for which "all parts of the known world had been searched." And in this garden there were birds and tamed animals; there were pools and running streams. Indeed, it needed a constant force of slaves to keep pumping water to it from the Euphrates. It is easy to understand why this was called the Hanging Garden with the native weeping willows, the rose bushes and other flower-laden shrubs, drooping, hanging over the edges of the terraces.

Imagine yourself a privileged visitor in Babylon—a city as ugly as a modern city of brick and stone. But rising in grandeur in its midst is this hill of loveliness. Slowly you climb the winding stairways, often beneath arbors of vines and trees. Animals dart about, birds of brilliant plumage flash in the thickets. By the side of the walk, rippling over the glazed brick, water sings to you. The air is laden with the pungence of foreign flowers. Trees are heavy with their red and golden fruits. On you climb until you reach the uppermost terrace—the loveliest of all—"The Princess' Paradise."

Why should this stupendous but beautiful garden be constructed? Why must thousands of slaves toil for many years? Why?—because Nebuchadnezzar, monarch of Babylon, wished to please his wife, Amytis, a beautiful princess of Media. In unlovely Babylon she sighed and pined for her truly beautiful homeland; for its trees and flowers, its hills and singing waters. So her indulgent husband built for her this one of the Seven Wonders of the World.

No one should be selfish with a garden. The joy of gardens is more joyous when shared with others and cultivated for their pleasure.

The Mystery of Fluorescence

By WILLIAM D. QUINN

Photographs By B. M. Shaub

WILLEMITE CRYSTALS IN WHITE CALCITE

A specimen from Franklin, New Jersey. Over a long range of wave lengths under light this mineral emits a very strong greenish-yellow fluorescence. This, and the other minerals here shown, acted upon by invisible ultra violet rays, transformed these rays to visible light that acted on the photographic emulsion. They "took their own pictures".

IT MATTERS little *where* you make your first acquaintance with fluorescence, that first meeting is bound to be an unforgettable experience. It may be that some mineral collector of your acquaintance invites you to his home; you may be fortunate enough to visit one of the western tungsten mines; or you may be ushered into the little dark closet at the Agassiz Museum of Harvard University, or one of several museums, where the mineral "ghosts" are kept.

"Black light", or the ultra violet ray, produces a phenomenon technically known as photo-luminescence. Photo-luminescence is subdivided to include fluorescence and phosphorescence. Fluorescence is the property some substances possess of emitting color other than their own—or their own color intensified—while being acted upon by ultra violet rays. Phosphorescence is the phenomenon observed when all light rays are shut off. A phosphorescent subject may, or may not, be fluorescent.

Sir Isaac Newton demonstrated, in the seventeenth century, that white light may be split up into all the colors of the rainbow. Newton found that light, when passed through a triangular prism, would come out as light of colors that ranged from red to violet. Later, through Herschel's work, it was discovered that beyond the visible rays of the spectrum are others that are invisible. A thermometer placed beyond the visible spectrum registers more heat than when in the colored light. Sunburn comes from these rays. They were called ultra violet and infra red.

In 1853 Sir George Stokes described, in the *Philosophical Transactions,* some curious experiments. He had discovered that certain substances, when placed in the apparent darkness beyond the violet light, instead of remaining invisible, became luminescent. This phenomenon was named fluorescence after the mineral fluorite, which shows it to a remarkable degree.

Soon scientists began producing artificial sources of the ultra violet rays. Minerals were sealed up in vacuum tubes and subjected to high voltage. It was found that diamonds turned green, red, and yellow; that rubies seemed actually on fire. By coating a piece of cardboard with certain fluorescent chemicals, the fluoroscope, which is so valuable an accessory to the X-ray, was invented. High frequency sparks from iron, copper, zinc, and carbon electrodes produced further results in the search for the obscure facts.

The magic of fluorescence produces inconceivably spectacular effects, some of them—most of them—beautiful in the extreme. As all must be done under the cover of darkness, these effects are often startling; always impressive. Many are familiar with the uncanny results achieved in a darkened theatre by tinting costumes and scenery with fluorescent paint and oils. It is highly probable that the luminosity of many of the apparitions summoned by dubious spiritualism has actually been invoked through the medium of the older types of lamps.

The most superb fluorescent subjects are minerals. Mineral collectors claim particular rights to the Aladdin's lamp that transforms the most unattractive quarry waste into an object of such ravishing radiance.

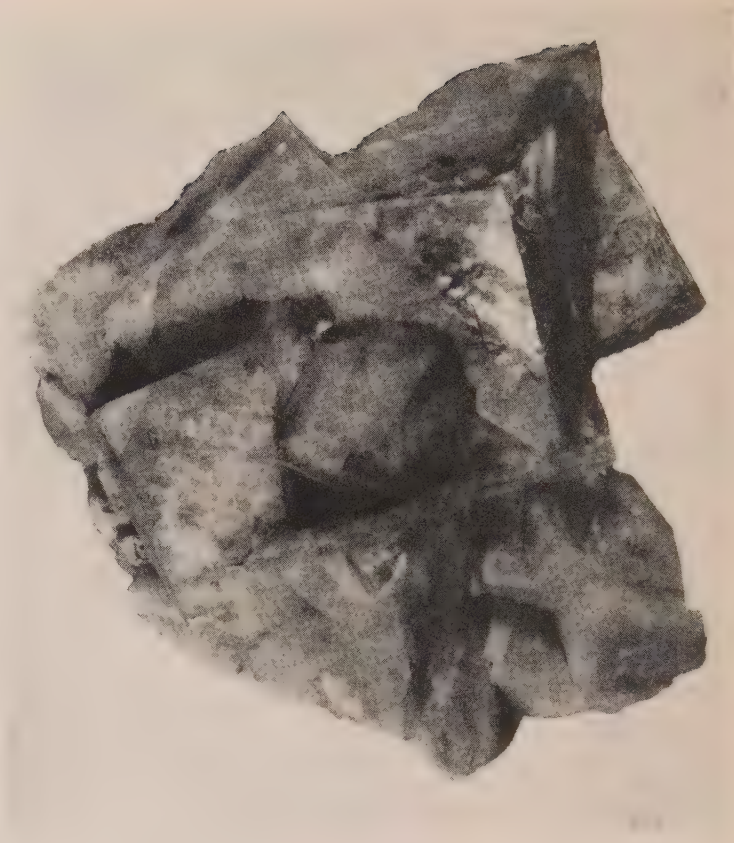
In May, 1933, the argon glow lamp, manufactured by General Electric, was introduced to collectors at a price of fifty cents. The fluorescence produced by this little two-watt, argon-filled affair rivalled that of the much more expensive lamps. It had a life of more than one thousand hours; it was a convenient size and could be conveniently replaced. The more expensive lamps were delicate, erratic, decidedly dangerous, and out of the question for the average collector.

The subject of fluorescence was, until this time, a comparatively obscure one—even to most mineralogists. Immediately following the introduction of the argon bulb, interest ran high. The mineral collecting public swamped

the manufacturer with hundreds of orders. Experimenters everywhere were discovering new and unique facts. Mines were opened to supply them with gorgeous minerals. A South African mine produced an ordinarily unattractive black zinc sulphide that turned to glowing gold under the magic rays. A poor Canadian farmer acquired moderate wealth through a fluorescent mineral discovered on his property.

In November, 1933, a greatly improved mercury vapor arc became accessible to the enraptured collectors. Much more expensive than the argon bulb, it was suitable for museums, which discarded their newly-installed batteries of argon bulbs and turned to the "Nico" lamp. All over the country collections were installed. Wealthy collectors and museums rivalled each other to possess the choicest material.

In the Philadelphia Academy of Arts and Sciences, for example, one enters a short dark passage. One passes a pair of photo-electric cells that illuminate, by ordinary light, a case of minerals, none of which are particularly interesting. Soon the lights are extinguished, and the ultra violet go on. What an incredible transmutation! An enormous piece of colorless fluorite is a glorious blue; a hideous doorstop of sphalerite blazes red and green; the pale wernerite is a dazzling yellow; ruby kindles red; common calcite assumes imperial scarlet; ambers relume; baleful opals glow like living coals. Standing there in the darkness, one realizes that the specimens are themselves glowing; that these unearthly colors emanate from the depths of the stones themselves.



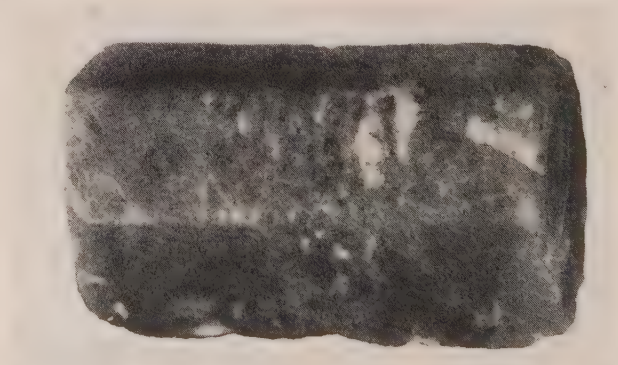
FLUORITE FROM CUMBERLAND, ENGLAND

The mineral frequently occurs in cubic crystals, and usually exhibits a strong fluorescence, which took its name from the mineral

When the ultra violet rays have ceased, there obviously should be darkness absolute; but there is not. Many of the minerals continue to luminesce, almost as brilliantly as before, with absolutely no light present.

Very few substances do respond to the ultra violet rays. Also similar specimens of a given mineral from different localities do not necessarily react in the same way. One may respond, the other may not. Fluorite from different regions becomes green, blue, violet or red; that from some localities does not act at all. Under different lamps the colors shown by the same species may be surprisingly dissimilar. A mineral that is found in the Chisos Mountains, Brewster County, Texas, is ordinarily pale pink. The Nico lamp transforms it to brilliant red. Under the iron arc it becomes still another color, while the argon bulb produces no fluorescence but a brilliant green phosphorescence! It is truly versatile.

Diamonds are curious subjects. To obtain the half dozen beautifully responsive stones in the Harvard fluorescence booth, Professor Palache had to test several hundred. One wealthy Boston woman, who owned an exceedingly valuable diamond necklace, having read that the "true test" for these gems was their responsiveness under the ultra violet, was horrified to find that only one or two of hers glowed in the least. Of course all genuine diamonds do react when exposed to the rays of radium; but some people prefer to believe that all sources of luminosity produce like results with these gems.



A HEXAGONAL CRYSTAL OF RUBY

The natural ruby frequently fluoresces a fiery red; the synthetic material likewise gives a brilliant red. Thus ultra violet ray does not distinguish them

Certain authorities believe that the only positive method of discerning the natural ruby from the product of the oxy-hydrogen furnace is that the man-made product phosphoresces, while the natural stone does not. Formerly it was possible to differentiate between natural and synthetic stones by searching for microscopic wavy lines, elongated bubbles and tension cracks. Now the man-made ruby has achieved such a state of perfection

that some experts claim that the synthetic ruby can only be detected through its phosphorescence. The fact that it requires an entire room full of vacuum pumps, and such apparatus, to accomplish the first mentioned experiment, is probably the real reason that many research workers and collectors believe that 98 per cent of all rubies on the market were created in European factories.

Many commonplace articles give startling results under the rays. Oils and ointments become bright blue and green; gum gaitti is spottled with rose and green; smelling salts are green; sheepskin becomes brilliant yellow. Paraffin, ginger and coffee stains acquire unexpected hues. True teeth are blue; false ones orange. A mixed mouth is rather breath-taking.

Perhaps the most curious application of fluorescence was the printing of the article "Black Light" in the February, 1938, issue of *Rocks and Minerals Magazine*. The print, by ordinary light, was pale orange, and difficult to read; with the fifty-cent argon bulb the printed page took on an incredible green luminescence, bright enough to be seen across the room, clearcut and easily read.

The first question that enters the mind of a practical man, even when he is shown an object of great beauty, is, bluntly, "What good is it?" Not only do ultra violet rays produce objects of incredible beauty, but they are indispensable to medicine. They have been used to detect fakes of old masters. Many laundries identify their customers' clothes with fluorescent ink. During the World War, captive German spies were apprehended sending messages, written between lines of uncensored material, in fluorescent ink made from aspirin. United States currency has been marked more than once with "invisible numbers", these later to become visible to the great sorrow and perplexity of criminals. Ultra violet rays are daily employed in the largest western tungsten mines, and in the New Jersey zinc mines. Valuable ore, otherwise not to be distinguished from the mother rock, is thus saved. The cathode ray tube depends on its willemite screen; X-ray on the fluoroscope.

Great caution should be exercised when handling ultra violet energy rated below 1800 Angstrom units. The argon bulb, of course, does not come under this heading. All the larger lamps, however, such as the arcs, should never be looked at directly without goggles. Aging of skin tissue, serious eye trouble, and even cancer and tuberculosis may result from careless operation. No rays from the sun below 2900 A.C. can penetrate our atmosphere.

Why some substances fluoresce, and why others do not, is an enigma. Why anything fluoresces is another enigma. Scientists have found it convenient to place all responsibility for the fluorescence or non-fluorescence of a mineral on microscopic impurities, especially manganese. It is known that there are active centers within the fluorescing bodies that are subject to fatigue. These may become exhausted and are, thereafter, non-luminous. Fluorescent substances when pulverized lose much of their brilliance. Why does all this happen? Who shall decide when doctors disagree?

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Expert Diver

By ARTHUR H. FISHER

In the small mammal house of the Washington Zoo an otter is exhibited in a small enclosure with a glass-fronted tank. This otter is seldom without an audience as he glides in and out of the water with practically no more disturbance of the surface than would be made by the flat blade of a knife. This ability of the otter to make a splashless dive apparently is not enjoyed by other aquatic mammals. Even the stream-lined sea lions toss a high wave as they enter the water, which in a photograph blots out any sign of the snout after it pierces the surface. This is not true of the otters, as is plainly shown in the accompanying photograph. In this instance the animal has left the top of the rocks at high speed, a distance nearly twice the length of its body, yet the water disturbance is so slight that head and neck are plainly shown beneath the surface.

As a matter of fact, the tiny ring of disturbed water is accentuated by a photographic register of its shadows.

THE CLOUDED LEOPARD AT THE FIELD MUSEUM IN CHICAGO
This specimen, which came from an animal dealer in Almora Province, India, is artistically posed. Actually little is known of the life habits of this elusive and little-known feline

Clouded Leopard—a Cat Aristocrat

By BRENT ALTSHELER

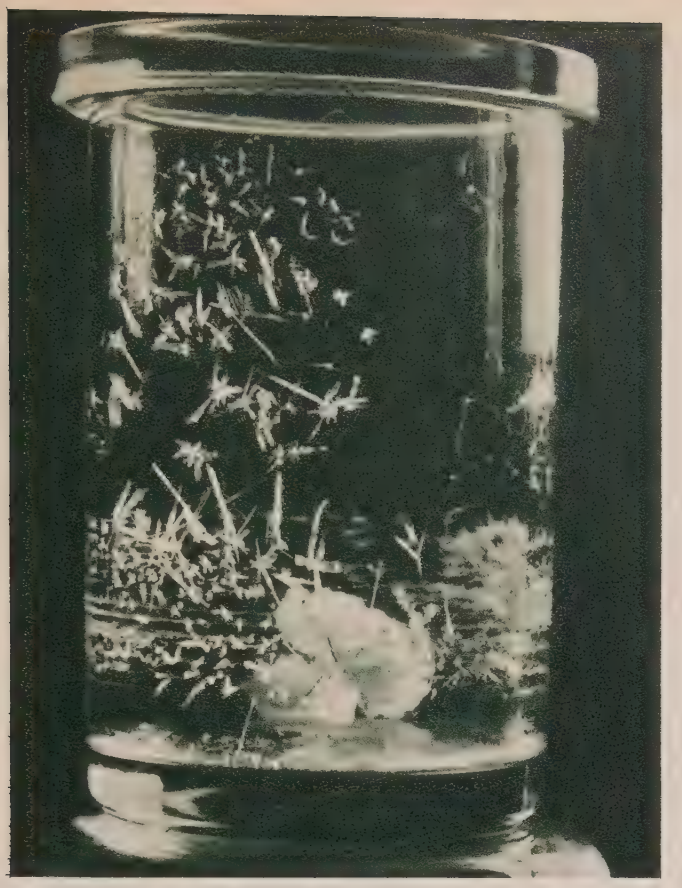
IF DIAMONDS were as plentiful as daisies they would still be beautiful but not so expensive and enduring. If the clouded leopards, *Neofelis nebulosa,* were as numerous as the lion and tiger, they would remain the paragon of feline pulchritude, but the zoo would not have to pay such a high price for a public exhibit. The discriminating taste for beauty and grace in animal nature is gratified by the unique color pattern of this cat and the abundance of its caudal appendage—a tail that this leopard's numerous feline cousins, domestic and feral, and all the way down the social scale to the lowly bobcat, may well regard with jealousy.

The most recent world-wide survey of clouded leopards discloses only three animals in captivity. One is in the National Zoo of Washington, D. C., and two are in the St. Louis Zoo. Other zoos, in the past, have shown them from time to time, but the price is so high and their life in captivity so brief that few zoos can afford the luxury. There is a mounted specimen in Harvard's Museum; another in the Field Museum; three in the British Museum, London, and one in the Leiden Museum, the Netherlands. For study, skins and skeletons only are found in the large museums of New York, Philadelphia, Washington, Paris, Berlin, Singapore, Bombay, and Sarawak (Borneo). Most, or all of them, are supposed to be the relics of zoo specimens that lived a short span and expired in captivity.

So far as library records reveal, all of these specimens were caught in native traps and sold in the nearest animal marts to zoo collectors, and with them came the meager details of their life histories. There is no available record of any white man having had contact with the clouded leopard in its native habitat, with but one exception. W. H. Matthews is said to have collected them in Northern India between the years 1920-1934, but his specimens have not been otherwise located.

In stature, the clouded leopard is comparable with other leopard species and with the panther, perhaps a little smaller. They are not vicious, in fact they are said to be quite harmless, with no dangerous tendencies. They are sometimes found about human habitations, but they have never bothered children. They are forest-dwellers and everywhere have decided arboreal habits. They are fond of fowls and small mammals, and if they have any vegetarian tastes they have not been reported. These cats are perhaps the most individualistic of the entire feline family. Their form must have been well developed before seismic disturbances separated all the large insular areas from the Asiatic mainland, except the Philippines, where there is no evidence of their existence. They must have ranged widely, for an outline of their present habitats is larger than that of the entire United States. They are found in the islands of Borneo, Hainan, Formosa, Java, and Sumatra, and have thirteen isolated mainland ranges, mostly in China, India, and Indo-China.

They are found only at high altitudes, usually from 5000 to 7000 feet elevation. Ancient Asiatic civilization, following prehistoric times, must (Continued on page 55)



A CRYSTAL GARDEN

By F. L. PICKETT

Although a botanist by profession, I have long been interested in crystal formations and in the photography of crystals. Snowflakes are, of course, crystals *de luxe*, with their infinite variety of form and beauty. They are, however, elusive subjects for the camera and do not linger long for study.

So, for my crystals, I have fallen back on my "crystal garden" that is shown in the picture above. This is nothing more complicated than a small, very clear glass jar with a glass lid ground on. Into it were placed a spoonful of crystals of paradichlorobenzene, a substance common on the market under the name of Dichlorocide, and useful in the eradication of household insect pests.

This crystal garden of mine grows on the sill of my

office window. It is well placed there because the sublimation point of the chemical in the jar is slightly above room temperature. Sitting with the radiator on one side and with a cool wind blowing under the window on the other, the garden reveals a constantly changing crystal "growth". The two lower photographs on the first page of this article show the crystals that were formed by raising the temperature of the glass jar so that a considerable quantity of the material was vaporized. Then the jar was subjected to a sudden drop in temperature.

The varied crystal formations shown on this page were obtained under the normal conditions on the window sill, with the radiator and the wind from outdoors conspiring to bring about the formations. The variety of design

in this picture indicates graphically the fascination of this "garden".

The picture above at the left is a profile view of a mass of crystals formed on the lower side of the glass cover. To vary things a small amount of ether was poured into the crystal mass, and the garden produced the results shown in the picture above, on the right. These were formed in the window sill situation. This experiment suggests the interesting possibilities that may be obtained by introducing other gases and observing their results.

The two pictures below are merely variations of design, and were photographed shortly after the other pictures on these pages were made.

I have failed to find any truly satisfactory explanation for the wide variety in crystal formation provided by this particular type of material. It is, in any event, exceedingly versatile. Perhaps others may find as much pleasure in observing and studying these formations as I have. And, perhaps, they may be able to delve more deeply into the secrets of this manifestation of Nature's artistry.

WHEN WINTER CLAIMS MOUNT HOOD

By IRVING E. LINCOLN

Photographs by the Author

When driving snow and sleet bring winter's raiment to Oregon's Mount Hood, the last, tough, wind-twisted conifers that have struggled up the ridges to the timberline stand as wierd, fantastic forms fashioned by the storms. As the rain and snow are driven against the trees they freeze into ice, and layer upon layer of snow feathers are built out into the wind. Sometimes these timberline trees are laden with icicles of clear ice that glisten in the sunlight like cut-glass chandeliers. Or the wild wind's masonry decorates the trees with flags of frozen snow, unfurled into the wind, and leaves the lee side practically bare. This snow-ice is carved by Nature's fierce artificer into marvelous statues of entrancing beauty.

A rare experience awaits those who ski over a layer of ten feet of snow, from Government Camp at three thousand six hundred feet elevation up the mountain to Lone Fir Lookout above timberline at sixty-five thousand feet. On a clear winter afternoon, after a blizzard, they pass through labyrinthine passageways of rarest

Wildlife Management and our Big Game Animals

By WILLIAM M. RUSH

In April, 1938, the American Nature Association began publication of a Quarterly Bulletin as a means of presenting more exhaustive discussions of conservation questions. Many members of the Association, and others, have urged that the material in these Bulletins be given wider circulation through publication as an integral part of Nature Magazine. In recognition of this demand, therefore, the Association announces the substitution of special inserts, of which this is the second, for the Quarterly Bulletin. A limited number of separates of this insert will be printed and made available to members of the American Nature Association, and to others who can aid in furthering conservation education, to which the Association is dedicated.—Arthur Newton Pack

"WILDLIFE CONSERVATION," "game management," and "land planning" are terms that have become familiar to the American people during the last two decades. There are thousands of organizations whose sole purpose is the preservation of the outdoors, and the wildlife that is such an important adjunct to it. These organizations hold innumerable meetings each year where wildlife is discussed in a more or less intelligent fashion, and the conclusions reached are imposing in number.

Starting with small local "rod and gun" clubs of a dozen or so members, the sportsmen of the country are organized into state, regional and national groups, with a total membership of several million. Other interested and important classes, such as the ornithologists, mammalogists, ichthyologists, foresters, gardeners, wilderness lovers, and others, have their own organizations to promote the welfare of whatever happens to interest them. All these classes represent the great Public—the Public that wants *its* wildlife properly managed.

The states and federal government have bureaus and departments made up largely of professional conservationists, part of whom are game managers, men who make it their life work to see that wildlife in its multitude of phases is given its share of attention. These men are responsible, not only to the public, but to the wild creatures as well, for doing their work efficiently, honestly and faithfully.

All of these conservation agencies are pretty well financed. The public has been willing to contribute with reasonable generosity to all forms of conservation and most particularly to those that deal directly with wild animals. I have never known a worthy project having for its object the betterment of wildlife conditions that has failed because of lack of financing. Money is always available for these things; many millions of dollars have been contributed by individuals and appropriated by the state and federal governments in the last few years for such work.

"Game management," or the broader term, "wildlife management," has been given various definitions in more or less technical and confusing language, but it means so managing the wildlife of the country that there will be enough birds and mammals to shoot, trap, photograph, or study, for economical, mental, spiritual or physical reasons. Wildlife management has been the theme of many conventions and meetings, and the subject of sober thought by our conservationists. Its literature has already mounted to formidable size.

There are innumerable factors affecting wildlife in its thousands of forms in the United States. Climatic variations, economic conditions and constantly changing environment go to make the situation a challenge to the best efforts of the administrators and research men who are our game managers. But sometimes, as one wades through his piles of reports on research projects, or reads the many pages of the proceedings of some conservation group, he wonders if many of the game managers have not lost sight of the good old common sense approach to the problem and substituted high sounding but meaningless jargon.

Let us take a look at some of these reports and see what we can make of them. (The reader can take up any bunch of bulletins or reports on the subject and make up much the same sort of a case.) Big game management has been much in the limelight—suppose we view briefly some of its phases.

The space now available will not permit a thorough analysis of big game management in the United States, either its history or present status, but I should like to show how big game has been grossly abused, without placing the blame on any particular agency, and suggest some remedial measures. I shall also attempt to show how the people have been wilfully misled into thinking that "game management" is an efficient, intelligent and forward-looking movement, handled by experts who are doing great things for wildlife and its restoration in America.

Concerning Antelope

The first report that comes to hand is, *Status of Pronghorn Antelope, 1922–1924,* Department of Agriculture Bulletin, No. 1346, August, 1925. On page 23 we find this interesting paragraph:

"Almost throughout its range the pronghorn is decreasing. Each succeeding year some of the smaller herds marked on the accompanying map are certain to disappear, and only in the most favorable areas, where they are *carefully protected,* is there hope for the long survival of these interesting animals. In perpetuating herds of antelope in the different states one of the principal factors will be the *interest taken in them by ranchmen, local sportsmen and other residents.*" The italics are mine.

On page 3 of this same report is a tabulation that places the total number of antelope in the United States at 26,604.

Thirteen years later, the Biological Survey, Department of Agriculture, Leaflet BS-122, estimates that in 1937 there were 131,555 antelope in the United States—a gain of almost 400%, and predicted further increases, which prophecy is borne out in Wildlife Leaflet BS-142 of August, 1939, which indicates a *42% increase for one year.* It was largely the same men who made the estimates in 1924 and 1937, and these men are presumably informed on the matter, so we accept the figures as based on their best judgment.

Did "wildlife management" bring about this phenomenal increase in the antelope population? Was it planned by the game managers of the several agencies interested in the species, and, if so, what methods did they use to bring about a 400% increase in antelope in thirteen years? Was the range, the food supply of the antelope, greatly improved? Were the natural limiting factors of the species removed? Did law enforcement bring about this wonderful change? When did the game managers start this comeback, and where are the plans they used? Did they heed the advice given them by Dr. Nelson in Bulletin No. 1346, i. e., "careful protection," and "interest taken in them by ranchmen, local sportsmen and other residents"?

The answer to most of the foregoing questions is: "No." Few, if any, of these things were done by game managers, at least for the primary purpose of benefiting the antelope. The species was given no special attention except the declaring of one or two open seasons, which resulted in the antelope taking an awful beating at the hands of the hunters. I do not believe that even one additional game protector was assigned to guard the antelope anywhere on its range. Yet the increase is very easy to account for—the antelope were merely given a chance. The two big factors that favored them were purely accidental as far as benefiting the antelope was concerned.

Unremitting warfare against the coyote, the principal natural enemy of the antelope, has been the most important factor. The U. S. Biological Survey had spent with its cooperators about twenty-five million dollars during this thirteen-year period for control of injurious mammals, a great deal of this money going for trapping and poisoning of coyotes. With this money it should be easy to control any species of animal life, and the coyote has been kept sufficiently in check to allow the antelope to stage their come-back. The *primary purpose* of coyote control, however, has been, and still is, the protection of the woolgrowers' sheep, *not* the antelope.

I had the opportunity to keep close check on the growth of one antelope herd in Montana. This was band No. 11 in Department of Agriculture Bulletin No. 1346 (mentioned above), near the town of Square Butte, Montana. There were about 60 in the band in 1922-1924.

William P. Sullivan came to this section in 1897 and saw the practical extermination of antelope by wolves, coyotes and poachers, coyotes being by far the most destructive factor. The last wolf in that section was killed in 1925, but coyotes still did considerable damage to the antelope, so Mr. Sullivan employed John Youngboy and several other Blackfeet Indians to clean up the coyotes. This they did most effectually. Coyotes were exterminated on this range except for an occasional immigrant, and these strays were killed as fast as they came in. All this was done at Sullivan's expense and initiative and for the express purpose of protecting the antelope.

On this 12,000 acre part of the Sullivan ranch there were 30 antelope in 1920, 39 in 1921, 51 in 1922, 67 in 1923, and so on up to 1931, when 576 were counted. There was an average year by year increase of about 31%, so that by 1934 there were nearly 2000 of these creatures in the vicinity and they were doing considerable damage to valuable crops owned by farmers adjoining the Sullivan ranch. The irate landowners shot a number of the marauders and the drain by illegal killing increased steadily. Protests were numerous and loud, resulting in the open season of 1936 and the practical extermination of the herd. (Only a few were left when I last visited this area in 1938.)

Incredible though it may seem, after all his years of work and personal expense in behalf of the antelope, Mr. Sullivan had to stand by and see them slaughtered during that unlimited flood of hunters in the open season of 1936, all that winter finding scattered carcasses where wounded ones had finally died from their injuries. Private enterprise built up this herd by strict coyote and wolf control, and restriction of shooting. Game management wiped it out by ill-considered hunting "regulations".

The next factor of importance in the growth of the antelope herds was the removal of the human drain. The period of antelope depletion, roughly from 1890 to 1915, was also the time of greatest settlement of their former range. Homesteaders were everywhere. Every available quarter section was taken up and fenced. Each settler plowed a few acres and pastured a few cattle, horses and sheep. Nearly all of them had dogs, which constantly harassed the antelope. The settlers needed meat and the antelope were handy. This was the era of extermination. Fortunately for the antelope the settlers could not make a living on the land and had to move out. Homestead abandonment was pretty well complete by 1918 and the antelope regained much of their free range.

Favorable public sentiment fostered by the leaders of

the various conservation groups has been another factor. It has caused a greater respect for wildlife on the part of would-be poachers so that the human drain on the antelope population is now and has been for a long time at a minimum. It would be well if the game managers would consider this point in connection with future work in the wildlife field. Education pays the largest dividends of any method of conservation, but to date it has received the least attention and the smallest funds of any.

Improvements in food conditions for antelope have been negligible. Their ranges, with few minor exceptions, have fared just about the same as all other western ranges. However, the antelope are fortunate in being able to subsist for long periods on western sagebrush, *Artemisia tridentata,* which grows in profusion over their entire range. In sagebrush they have a winter food supply that is relatively safe from domestic stock.

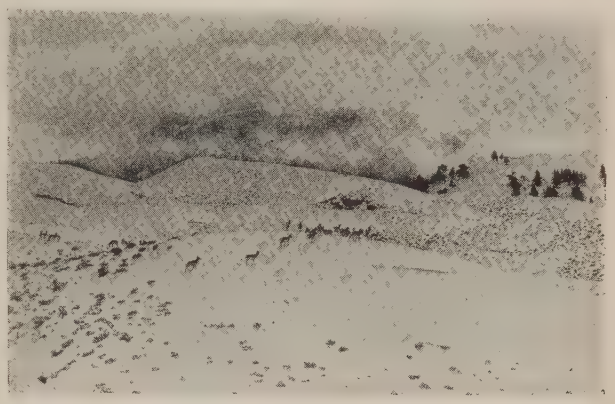
The Charles Sheldon Antelope refuge in northwestern Nevada was created in 1931, consisting of 30,800 acres of very heavily grazed domestic sheep and cattle range. In 1934, this spring, summer and fall range was fenced, excluding cattle and sheep, and by 1936, with greatly improved moisture conditions, the grasses and other forage plants showed a remarkable recovery. However, the antelope of this section had showed a tremendous gain previous to the creation of this refuge, so it cannot be claimed by game management that the refuge was instrumental in bringing about the increase.

A greatly improved *winter* range for antelope should result from the 539,000 acres added to the Charles Sheldon refuge in 1936 as a game range, under the joint supervision of the Division of Grazing and the Biological Survey, but the joker here is that the maximum number of antelope is fixed by the executive order creating the game range and all forage above the needs of this number is to be utilized by domestic sheep and cattle.

The *Federal* Hart Mountain Antelope refuge of 276,000 acres was created in 1936 within the exterior boundaries of the 945,000 acres of the Warner *State* Game refuge, which was created in 1930. It is all spring, summer and fall range and badly overgrazed by domestic stock. No funds were available for this refuge until 1937, and up to 1939 nothing had been done toward bettering conditions for the antelope except a slight reduction in number of domestic stock grazed on the area.

It is ridiculous for the game managers to claim that these two refuges have been an important factor in the impressive "come-back" that was staged by the antelope. Both refuges were established too late for that. Even now the Biological Survey claims only 3150 antelope for Hart Mountain out of the 28,550 in Oregon (and the 3150 are for the summer months only). For the Charles Sheldon it claims 4000 out of Nevada's 12,700. In Utah there are 35,350 antelope; New Mexico has 26,500; California, 14,000; Idaho, 12,300; Wyoming, 24,071. There are no Federal antelope refuges in these five states. (Wildlife Leaflet BS-142—August, 1939.)

How about the coming periods of thirteen, fifteen or twenty years? Can the ranges in the West stand a 400% increase from now to 1953, which would make a total of 657,000 antelope or thereabouts? The answer is, of course, "No." But how are the game managers to handle the problem? It is not too early to be considering plans for the increase. How many antelope are needed in the United States, and what is the goal in antelope population? Four states had open seasons in 1939. Will hunting antelope again become popular and the surplus above the carrying capacity of the range be in demand by the sportsmen? And when open seasons are declared, will the result be the same as it was on the Sullivan ranch in Montana? Will there be controlled hunting or wholesale slaughter? These and many other phases of the antelope question must be considered if game management meets its obligations.



ANTELOPE ON WINTER RANGE

Note the absence of all forage plants with the exception of sagebrush on this range north of Yellowstone National Park

In summing up this particular situation one is forced to the conclusion that the increase of 400% in the antelope herds was not planned. It was purely accidental as far as game management was concerned, although some of the game managers seem willing to claim credit for it in their reports.

What About Deer?

Next on my list is Bulletin No. 12, *The Pennsylvania Deer Problem,* Board of Game Commissioners, Commonwealth of Pennsylvania, 1930. On page 5 is this statement: "When the Board of Game Commissioners was appointed in 1896 deer were so scarce in Pennsylvania that the appearance of one of these fleetfooted creatures caused considerable comment. . . ."

Then, on page 66, we find the following: ". . . shall we reduce our deer herd to the carrying capacity of our range, or allow the farms, orchards and forests of the state to be destroyed, without possibility of compensation,—and a pitiful percentage of our young and growing deer die of starvation after all?"

I visited several forest plantations in Pennsylvania in 1934 and found that the foresters were completely baffled in reforestation because the deer ate up the young trees as fast as they were set out, and there was evidence of damage to the deer's food supply everywhere I went. Did game management find any place in this problem?

In the 17th Century Pennsylvania was one of the most populous wildlife areas in the world. There were the bison, moose, elk, white-tailed deer, black bear, wolf, bobcat, lynx and panther, as well as a great variety of smaller mammals. The whole state is particularly well adapted to wildlife in that it has a favorable climate and an extensive flora. The wild grazing animals were held in check by the meat-eating animals and a balance existed between flora and fauna that changed but little from year to year.

Between the time of William Penn, in 1682, and 1896, when the Pennsylvania Game Commission was created, this wildlife was pretty well wiped out. The upset began as soon as Penn landed, by the killing of deer, elk, bison and moose for meat and skins. Plowing of land and pasturage of domestic stock furnished further competition for the wild grazing animals. The bison, moose and elk were the first to go. White-tailed deer are more resistant to the advance of civilization and hung on longer, but they too were finally exterminated except for a few negligible remnants. The large predators were also exterminated, or practically so. The cutting of the virgin forests added to the suitability of the area as a game range, but the game was all gone. Men stopped hunting because there was nothing left to shoot. Here was a great area, admirably suited to wildlife but barren of all the larger forms in 1896. The stage was set for what followed. Deer were transplanted in various parts of the state from Vermont, Ohio, North Carolina and Michigan. They had no competition from other grazing animals. There were no predatory animals, and hunting was prohibited. The deer multiplied prodigiously.

HERD OF ELK IN WINTER
Without being fed these animals would find life difficult, with winter forage scarce and competition for food keen

Game management in the form of the "buck law" was initiated in 1907, but although many thousands of legal deer have been killed since then, the population has kept on mounting. The increase would not have been so great without the buck law, and there was a point somewhere—probably along between 1910 and 1920—when it should have been repealed and both sexes killed by the hunters.

It goes without saying that the Pennsylvania deer situation was not planned in advance. When deer were being imported, no one ever thought that they would so soon become so numerous as to be unduly destructive. Excessive damage to forests, crops and orchards by wildlife is not a part of wise game management.

The Elk Situation

The United States Forest Service has been publishing data on the number of big game animals on the National Forests for a long time. Absolute accuracy for these figures is not claimed, but as the Forest Service personnel is well scattered over most of the big game ranges and has been on the job for thirty years, they are in a better position than any other agency to make such estimates for the large areas covered by the National Forests. Any one single estimate, such as for one ranger district or even one forest, may be radically inaccurate, but the totals for a state are apt to indicate correctly at least the trend in game populations.

Since the Forest Service has studied the big game situation more than any other agency, we may ask what part has game management taken in certain aspects of it as presented in their reports? Also what part is management to play in the future with big game on the National Forests?

First, the deer and elk situation in the United States as a whole: In the 1923 report, *Summary of Big Game Animals on National Forests* the number of deer is given as 511,828. For 1938 the report, entitled *Estimates of Big Game Animals on National Forests,* gives the number of deer at 1,584,000—an increase of about 210% in fifteen years. There were thus more than three times as many deer in 1938 as in 1923.

Elk did not fare so well for this period. The figures for them are 49,540 in 1923 and 140,000 in 1938—an increase of about 182%.

Can the deer and elk ranges stand comparable increases during the next fifteen years? If not, what are the game management plans for the situation?

The State of Utah has perhaps the best controlled system of elk hunting in the United States, there being a special board for designating the number of elk to be killed by hunters in the various localities. Deer, however, are managed as in other states, under the time honored American system of game management, i. e., closed seasons, closed areas and bag limits. Elk were exterminated in Utah before 1910, but re-introduced by transplants from Yellowstone National Park. In 1925 there were 1564, according to the Forest Service estimate. In 1938 there were 4500—an increase of 188% in thirteen years, with controlled hunting in effect all the time.

Deer were not managed so wisely. In 1925 there were 18,421 deer in Utah. In 1938 there were 115,000—an increase of 524%, or more than six times as many.

The elk situation was planned from the start. Suitable ranges, containing both winter and summer ranges, were selected for the transplants. Regulated hunting was initiated through a *limited license system.* At the same time a modest yearly increase, up to the carrying capacity of the range, was provided. The deer, however, were soon out of control, damaging public and private property and lacking sufficient food supply.

Oregon has also had transplants of elk from Yellowstone Park, besides some original herds of Olympic elk, and in one place, at least, a cross-breed of the two. Here are the figures for Oregon: Elk: In 1925, 3689; in 1938, 19,000—an increase of 414%. Deer: In 1925, 58,869; in 1938, 141,910—an increase of 140%.

These figures do not show how serious the problem is. That appears when we break them down into species. Eastern Oregon has the Rocky Mountain species of elk, while west of the Cascades there are the Olympic, Rocky Mountain and a mixture of the two.

For the eastern Oregon National Forests the figures are: In 1925, 2924; in 1938, 17,890 elk—an increase of 510%.

For the Cascades and western Oregon National Forests: In 1925, 765; in 1938, 1210 elk—an increase of 58%.

The deer in eastern Oregon are the mule deer and in the western part of the state Columbia black-tailed. For the eastern Oregon forests the figures are: In 1925, 24,000; in 1938, 103,000 deer—an increase of about 333%.

In eastern Oregon, where the increases are so great, two outstanding conditions prevail: Predatory animal control has been intensively practiced for many years; the human population is sparse and only one deer per person may be killed.

For the Cascades and the western Oregon forests comparative figures show: In 1925, 34,820; in 1938, 37,700 deer—an increase of about 8%.

Western Oregon has a relatively dense human population, two deer are allowed per person, and predatory animal control is not so intensively practiced. The difference in these two game management practices results in a difference in growth of deer populations of 325% over a period of thirteen years.

This is not all of the Oregon problem, which is typical of a large percentage of western game ranges. There are a number of problem areas on both public and private lands, the most critical of which is Murderers' Creek deer. This area on the Malheur National Forest and adjoining private lands is another Kaibab in degree of damage done to range lands and in the number of deer starving to death. Murderers' Creek was started as a game refuge, and, with no natural checks to the herd's increase in population and no hunting, the matter soon got out of hand. The range is badly damaged and will be much less productive for many years to come, and, although hunting is now allowed and even does were taken last year (two per hunter), the take does not yet equal the increase, so the problem is an increasingly serious one. What are the plans for handling this situation? What will it be thirteen years hence?

The Food Supply Problem

One thing that it seems difficult for many game managers to understand is that no game population can long endure if the range, which is their food supply, is not protected. It takes a long time for an overgrazed, badly-eroded range to recover. Five years—even twenty years—is a short time compared to the hundreds and thousands of years that it took to build up the top soil to productiveness. Soil is easily lost and hard to rebuild.

Nor is the solution found in the remedy so glibly suggested by the uninformed: Remove the domestic stock from the National Forests. This method allows larger herds of game animals to be built up, but that may only mean a more serious problem in the future. There *are* some places where game herds must have more range and the only way to meet this need is to take range in the National Forests, or public domain, away from domestic stock, and give it to the game, but this practice must not be considered a panacea for all cases of elk and deer overpopulation.

Is it good game management to allow herds of big game animals to develop to a point where a large part of them succumb to starvation? Yellowstone elk starved to the estimated number of 14,000 along the Yellowstone River in 1920, a loss of 60% of the northern herd. (Park Superintendent's report for 1920.)

"CINNAMON" BEAR EATING GRASS

Bears in the United States are increasing, save for the grizzly, in most states, except a few in the West

Fifty to eighty per cent of the deer in western Montana and northern Idaho starved to death during the winter of 1931-1932; 500 to 1000 elk starved on the south fork of the Flathead River in 1932-1933; 3000 deer starved on Murderers' Creek in Oregon in 1937. In 1931-1932, deer to the number of 10,000 starved in the John Day section in Oregon. The loss from lack of food in the eastern part of the state probably exceeds many times the kill by hunters. These are not isolated instances. They are rather common on the big game ranges of the West.

Is it good game management to allow herds of big game to become so extensive that overgrazing, soil erosion and extreme overbrowsing of the shrubs and forest trees result? Three hundred thousand acres of what was once some of the finest grazing in the Rocky Mountains have been badly damaged by elk in Yellowstone Park. Sun River and the south fork of the Flathead in Montana were badly damaged by elk. Numerous areas all over the West are overgrazed by deer and elk.

Eventually these situations will be corrected. Nature will take her course. Some winter when the weather is unusually severe, most deer may starve. Then the range will have a chance to recover. *But is that game management?*

In Washington State

Washington originally harbored a great variety of big game species. These include elk, white-tailed deer, black-tailed deer, mule deer, mountain sheep, mountain goat, and grizzly and black bears. Moose and caribou, originally rare on its northern border, are now gone, and mountain sheep nearly so. Its big game situation is interesting because this state has one of the most progressive State Game Departments in all North America. It has an excellent enforcement division, efficient game farms and fish hatcheries, a staff of biologists who earnestly seek for the facts in game problems, and a Commission free from politics and honestly working for the welfare of wildlife.

Washington, like Oregon, has two sets of conditions as far as big game is concerned: Mule deer and Rocky Mountain elk live in the east; Columbia black-tailed deer and Olympic elk in the west.

According to the Forest Service data the populations are as follows:

Deer: East, 1925, 9950; 1938, 47,470—a gain of 385%. West, 1925, 14,790; 1938, 20,000—a gain of 33⅓%.

Elk: East, 1925, 499; 1938, 2700—a gain of 440%. West, 1925, 8300; 1938, 9800—a gain of less than 12%.

The gain for Columbia black-tailed deer is four times greater than in Oregon, but Washington allows each hunter only one male deer while Oregon allows two deer, only one of which must be a male. Cougars are fairly plentiful along the coast ranges of Washington, more so than they are in Oregon, but other factors are almost the same.

Washington keeps better than average book accounts on its game. From the *Third Biennial Report of the Washington State Fish and Game Commission,* for the biennium 1936-37, the following extracts are taken:

"License sales increased from 129,622 in 1933 to 207,807 in 1937." (Page 7.) "A survey . . . revealed that $28,500,000 was spent in connection with hunting and fishing in 1936." (Page 10.) "A total of 5760 trapping licenses were sold . . . a gain of 29.9% over the previous biennium." (Page 21.) "1937 deer kill 5651—a gain of 11% over 1936. 1937 elk kill 1013." (Page 52.) "Deer and elk are increasing over most of the state. . . ." (Page 55.) "The elk loss, which is directly attributed to an overbrowsed condition in this region, is listed conservatively at five hundred animals." (Page 57. Region under consideration is Olympic Peninsula.) "70,407 big game seals sold." (Page 72.)

Washington sold 70,407 license tags for big game animals, yet has only 67,750 deer and 10,000 elk to kill. But these 70,407 hunters killed only 5651 deer and 1013 elk. What is wrong here—only one animal taken for each twelve hunters? There were hunters enough, but they did not take enough animals. Ranges are overgrazed and damaged and many animals starve. Where does game management come in and how will the National Park Service handle the elk herd on the Olympic Peninsula now that it is under its jurisdiction? Will this area be another Yellowstone? Is starvation of elk and damage to range to be the story here?

Some clue as to why this kind of big game management is practiced in the United States may be gained by glancing at the source of revenues from which game agencies derive their operating expenses and the use they make of these moneys.

Accurate figures on receipts and disbursements are not available for all of the states. In fact, few keep really good records, but the average for any big game state is probably close to the following:

Receipts		Disbursements	
Big Game	40%	Big Game	2%
Small Game Licenses	25%	Game Farms (Birds)	20%
Fishing Licenses	25%	Fish Hatcheries	20%
Fines	5%	Law Enforcement	30%
		Overhead and Capital	20%
Trapping Licenses	2%	Predation Control	3%
Miscellaneous	3%	Research	3%
		Education	2%

Obviously game management is not giving big game animals their due share of attention. Big game turns in forty cents and two cents are put back into it. How can any business endure on such a basis? Education and research also receive scanty budgets compared to their value and importance.

It is *not* true that there is an abundance of big game range available for restocking and that the present problem areas are but a fraction of the suitable deer range of the country. It is *not* true that a solution of the big game concentrations lies in transplanting surpluses to other areas. Any appreciable extension of range for any of the grazing animals will have to be gained at the expense of the domestic livestock ranges, and under the present economic conditions of the country such an upset of the livestock industry is not justified. Management of the existing deer and elk herds on a reasonable basis should be demonstrated before any more extensive areas are added to the problem. True, there may be some minor areas where small herds of deer may be maintained, but the areas left where elk can be transplanted are small indeed.

"Conservation measures" and "game management" are being given credit for the preservation of big game species, but if the game management people are honest they should say something about the losses from starvation and range deterioration through lack of management, and should not hold out hope for an increase in game populations in the next twenty years comparable to those of the past two decades.

Game management has been practiced on a *scientific* basis in only a few spots in the whole United States. You can count them on the fingers of one hand—the Kaibab National Forest in Arizona, the Pisgah National Forest in North Carolina and the elk herds in the State of Utah. On a smaller scale the bison herd in Yellowstone Park has been well handled. On all other important areas it has been a hit or miss proposition, largely marked by wholesale starvation and damage to forage through overgrazing.

The Example of Utah

An example has been set. Utah has an elk commission composed of five men representing the Utah State Fish and Game Commission, the cattle-growers, the wool-growers, the U. S. Forest Service and the sportsmen of the state. This commission meets each year, considers all the reports from various sources on the different elk herds, then agrees on the number of elk that are to be taken by hunters from each band. The Game Commission and the Forest Service have investigators on the ranges throughout the year who closely scrutinize both the animals and the range. For, after all, it is the condition of the food supply that tells the story. Any range is overstocked, no matter how few animals graze on it, if it is deteriorating. The experienced range man is quick to note such signs as heavy use of the browse plants, increase of unpalatable weeds on the range, incoming of noxious grasses, lack of reproduction in forest trees, utilization of unpalatable species of plants, over-use of desirable weeds and grasses, and finally the start of soil erosion.

Soil erosion is like what Billy Sunday used to say sin was—"all smiles and dimples when it is young. . . ." The first sign of erosion is harmless looking—the loss of a bit of top soil here and there amongst the tufts of grass. Later these spots get larger and it is said that "sheet erosion" has started. This is the forerunner of the destructive "gully erosion" that all of us notice. Mountain soils are largely what are termed light, loose soils, and erode easily, particularly on the steeper slopes.

The experienced range man is not much interested in the number of grazing animals on the range. His first consideration is the *condition of the forage plants and soil.* If there is deterioration, he knows there are too many animals. If an improvement is noted, so much the better. If he is wise, he will not increase the stocking for a year or two after the first signs of range improvement because he knows it is a difficult and painful process to *reduce* the number of either game animals or domestic animals on any particular range. On the other hand, it is dead easy to increase their numbers.

In Utah such factors are given consideration in managing the elk herds, and with success. If it is found that 800 elk can be safely taken from the elk herds, 800 hunters are distributed in the localities where there are surplus elk, and 800 elk are killed. Compare this method with the practice of opening the season for a period of from five to thirty days and allowing 30,000 to 100,000 hunters to pour into the hills after these 800 elk! Why has not game management profited more from this example?

Elk and deer compete directly with domestic sheep and cattle for forage on the ranges and pastures of the United States. Their food habits are similar, and where any two classes of grazing animals use the same territory it is a double use. Even elk and deer on the same range may be poor practice, especially where the food supply is limited, because the elk is the larger animal and a more aggressive feeder. Eventually, unless closely controlled in numbers, they will crowd out the deer completely. In many areas it is a problem of winter food supply.

Elk and deer could compete with cattle and sheep if the latter had to stay on the range and rustle food during the winter. However, domestic stock cannot endure severe winters without supplementary feeding, and in many places in the big game states they use up practically all the forage during the summer on the winter deer and elk ranges. Then, when winter comes, the cattle and sheep are taken to ranches and fed hay, but the game animals have to stay on the open ranges without much to eat for the winter. Usually there is abundant summer range for all, but domestic stock use the fall and spring ranges too closely for the welfare of the game, and in all too many cases use practically all the winter range. So much of the hereditary deer and elk winter range is now owned by private individuals who use it to pasture domestic stock that the problem is indeed complicated.

Unless there is another human depopulation of the western range country, with the resultant removal of livestock, it seems unlikely that the game animals will ever again get the break the antelope did in 1915 to 1920, and unless there is a radical change in the practice of predatory animal control it is unlikely that game will benefit much more from this source. Predatory animal populations are apt to stay just about where they are now. There will be minor fluctuations from year to year, of course, but from all indications governmental control of coyotes, bobcats, bears and others will produce just about the results necessary to keep the present control personnel intact. There need be no fear that coyotes will become extinct under the present system. The Biological Survey has maintained a steady catch per year of about 80,000 for the past twenty years. This is the increase.

Something like $2,000,000 per year is currently spent in coyote control without any consideration being given to the place of the coyote in the general biotic scheme. There are values to the coyote as an individual and a species that deserve consideration. But the wool-grower is assured, on the one hand, that complete extermination can be expected with the expenditure of a little more money for the hire of trappers, while on the other hand the friends of wildlife are assured that extermination is practically impossible. An intelligent application of bounty payments offers the best solution to the predator problem.

Mountain Sheep

Mountain sheep have fewer chances to survive the next hundred years than any other species of big game. The *canadensis* group is susceptible to at least two serious diseases, scabies and pneumonia. I have not been able to find any evidence that domestic sheep are responsible for either of these diseases in mountain sheep. It is reasonable to assume that the scab mite was a parasite of wild sheep before domestication began and became a parasite also of the tame sheep as domestication progressed. These mites persisted on domestic sheep all through the years and came to the Rocky Mountains fifty years ago with them via Europe and the Eastern States. The same type of mite

persisted on the mountain sheep and came to this area via the land bridge that existed between Asia and North America some 50,000 years ago. The disease became virulent in mountain sheep because they were too closely concentrated on winter ranges following the usurpation of their natural ranges by cattle, horses and domestic sheep.

The lungworm of mountain sheep is *Protostrongylus stilesi;* that of domestic sheep *Strongylus* of several closely related species. This lung parasite causes the verminous type of pneumonia, and with it are often associated the bacterial parasites *Pasteurella ovis* and *Bacillus pyogenes,* organisms that have probably lived in the higher forms of animal life for millions of years. These diseases are peculiar to mountain sheep and are important limiting factors.

I know of but one or two minor efforts that game management has made in behalf of this vanishing species, and if they are to be preserved there must be given some carefully considered treatment at once, and that in large doses. On all of their present ranges the sheep are decreasing.

Black bears are increasing except in a few western states. According to the data of the Forest Service, the states of Utah, Idaho and Oregon show decreases. These are states where predatory animal control has been strict, and in Utah and Idaho, at least, poison has been lavishly used. Whether or not poison is an important factor I do not know, but it seems reasonable to assume that it is. The other western states show but small increases due to strict control on sheep ranges, where the bear is classed as a predator.

Grizzlies are now very scarce. They have decreased in number since 1922 in every state, and special game management is needed for this species if it is not to become extinct. A large area of mountainous country, reasonably free from people and domestic stock, is essential. Yellowstone National Park and its adjoining National Forests now contain about 600 grizzlies, northwestern Montana National Forests have at least 350 more, and northern Idaho a few, besides scattered remnants in several other states. Because of the nature of this animal it will not be possible to maintain large numbers of them anywhere.

Moose also will always be limited because of their particular food requirements. There is no place for many more of this species in the United States. The same is even more true of caribou. This country seems to be just out of their range. The mountain goat is an interesting species and I have often wondered why the game managers have not made more transplants of them, as they can be fairly easily caught and shipped. Their range requirements are not exacting.

The fur-bearing animals are another story altogether and a long one. It is enough to say here that no one seems to be giving them more than superficial attention.

One of the greatest impediments to progress in wildlife management is the seeming inability of the various major administrative groups to cooperate in outlining policies and a program. Cooperation is and always has been on such a frail basis that even an unimportant difference of opinion between the contracting parties threatens to shatter it to bits. Each agency wants to go its own way and sometimes each man within the agency is determined to pursue an independent course.

There is no national wildlife policy, no program on which *all* agencies can work. No one has even said what the goal in animal populations should be, much less worked out a program of land use and other economic adjustments necessary to attain the goal.

Administrative studies have been dignified with the name of research and they have furnished some data that has directly or indirectly benefited wildlife, but so much money has been wasted under the guise of "research" that it is a wonder the public does not become impatient at the thought of it. Some progress has been made in wildlife management, of course, but it has been minimal for the money expended. That is, if we consider *permanent benefit to wildlife* as the measuring stick rather than the number of man-days spent on projects of more or less doubtful value to the wild creatures. The individual worker, especially out in the field, is in general sincere, industrious and capable, but the whole movement lacks coordination and direction, and it is hampered at every turn by jealousy and bickering among its leaders.

Game management in the United States should at least do something about elk and deer if it is to live up to the expectations it has engendered in the people. Facts as to pitiful starvation losses, widespread range damage and failure of hunters to take surpluses should be given to the public, instead of such misrepresentations as "wonderful increases in game populations," "planned expansions of ranges," "acreages of present game ranges . . ." and other evasions of the issue that tend to confuse and mislead the public. More game managers should follow the example of Seth Gordon and H. L. Shantz in putting the facts of big game problems directly before the public.

There are plenty of deer and elk now in most of the western states and plenty of deer in many of the eastern states, if wisely used, to meet any reasonable demands made by hunters. All starvation losses could, with good management, be saved and made available to hunters, as well as the surpluses that are pyramiding the populations.

Wildlife management apparently holds out to the public hope for a restoration of all forms of wild animal life to their former abundance without taking into account the millions of people and hundreds of millions of domestic animals that must occupy the same territory with them.

Wildlife management apparently has not yet recognized that the soil and soil crops are the *capital stock* they have to work with, and that wildlife is the *interest* on this capital. Our people dug deeply into the capital stock (range deterioration) while there was plenty of interest (surplus game animals starved) to operate on.

Wildlife management seems too little appreciative of the obvious and common sense approach to its problems. Nature has her own unchanging ways of doing many things and these ways are plain and simple—rarely intricate or complex, as some of our conservationists, with what Stuart Chase calls a "tyranny of words", seek to make us believe.

Education, not mere propaganda, should have a more prominent place in the program. More thought will have to be given to the welfare of the wild creatures, even at the cost of glory to some individuals and agencies.

beauty. First, the thick conifers heavily festooned with gleaming garlands of soft snow; then, near timberline, where the biting wind hits the ridges, the snow on the trees has been beaten and frozen into crystals, or moulded into striking formations of fanciful design.

Evening comes, and the last rays of the sinking sun tint with rose these freakish shapes of pearl-like, crystalline snow, and throw long shadows over the rippled surface of the drifted, wind-packed surface. For a few moments, at twilight, the lingering sunbeams color the upper ice-clad crags of the mountain a warm, pink, unpaintable alpen-glow of inspiring beauty. Suddenly the color of the whole scene is changed into a still, cold, death-like whiteness. There is no sound save the whistling of the wind as it sweeps unobstructed across the face of the mountain.

As the twilight fades, these queer, transformed trees appear like fanciful apparitions—like sheeted ghosts emerging from marble-colored sepulchers dug out by the mad wind from the snowdrifts.

Soon the soft gleam of a silvery moon shines on the pure white snow, transforming the scene again into one of enchanting beauty, lovelier than the day, even more poetic than the dawn, or the sunset. The stars, like glittering gems deep set in cobalt blue, seem close enough to touch. The bright moon sheds a new and tender light.

Here, in truth, is a sublime spectacle, a marvelous nocturne of blue and silver and gold. It is a rich reward for the climb through snow-covered forest and the hobgoblin trees of the upper heights of wintry Mt. Hood.

Star Trailing

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These unusual photographs by Emil Pearson of Redgranite, Wisconsin, represent an interesting camera excursion. They were made by pointing the camera skyward on a clear, still night and giving a long time exposure to the film. As the earth rotates each star traces a path on the negative, leaving a record of its movement.

At the upper left the picture was obtained by pointing the camera in a northwesterly direction. The film was given an exposure of two and one-half hours, during which time it recorded the arcs traced by the stars as the earth spun.

Above is the camera record of the whirling vortex pictured by pointing the camera directly at Polaris, the North Star, and providing an exposure of two hours.

At the left we see the story of star motion in a different region of the sky. The camera was pointed a bit west of south toward the constellation of Orion; the three belt stars being almost exactly on the celestial equator, as one may gather by the straightness of the recorded course. The exposure in this case was one and three-quarters hours.

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HOST TO A LOON

By H. ROLAND PRICE

The great northern loon is not a frequent visitor to eastern Pennsylvania. To see one is, therefore, an interesting experience, but when the bird is sitting in the middle of an icy road in front of your car it's an adventure. At first I thought it was a Canada goose, because the birds are about the same size, and the loon, in its slate-colored winter plumage, does not look unlike a goose.

Apparently the bird had mistaken the glistening, ice-encrusted road for a stream, and had landed. This might have been fatal because the loon does not have the power to rise from land, but must patter along the surface of water to gain momentum for a take-off. The loon's wings were unharmed, so I took him home for some photographs and to become better acquainted. My strange passenger sat quietly on the seat as though used to traveling by automobile. Once my guest was established in an empty cat pen, I spent some time finding some smelts to feed him. I put a few in a large pail of water and placed them in the pen. The bird lost no time in dipping his head into the pail, seeming to enjoy bobbing and splashing water about. Dead fish were not to his liking, however, because he threw them out of the bucket and could not be induced to sample them.

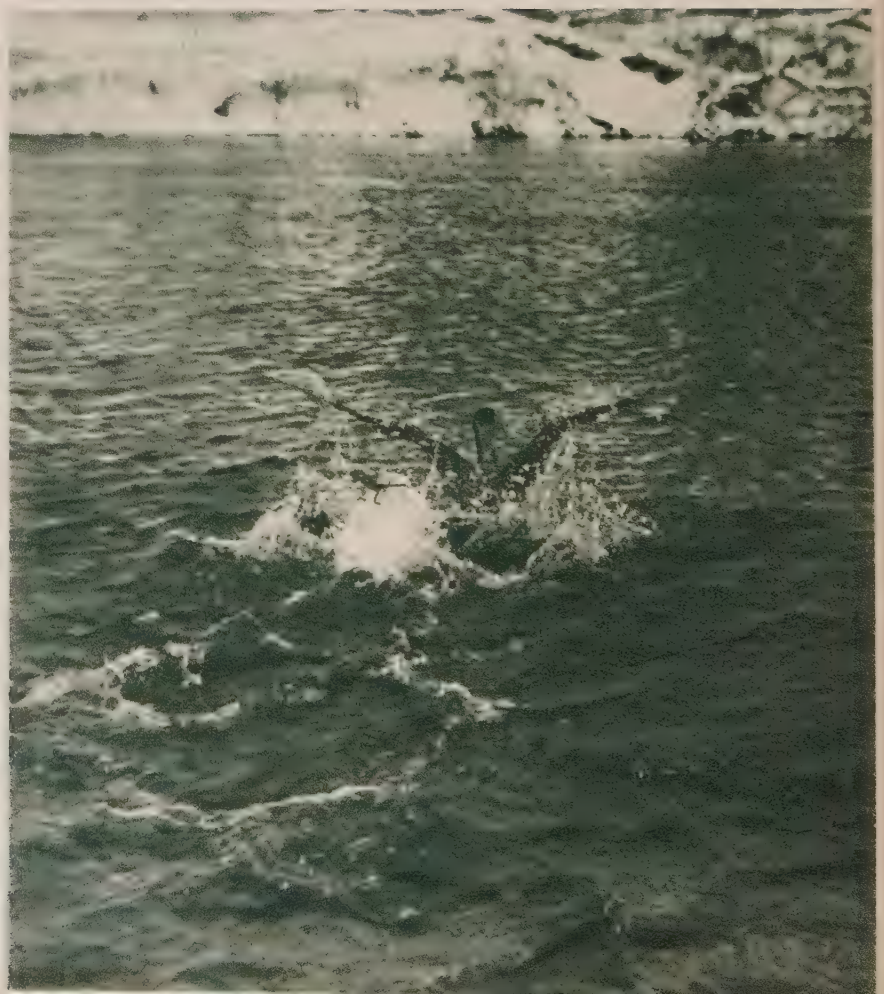
The next day being bright and clear I took several pictures of my loon, then prepared to take him to the water of the Delaware River. This time he was much more obstreperous, pecking and flailing me with his wings. As we neared water the bird became much more active, calling incessantly and trying to get out of the car. I wondered whether he could tell by instinct that he was nearing water, or whether he could hear the half-domesticated mallard ducks playing near the bank. There seemed no question that he knew he was going to be released.

Placed on the water, the bird taxied for quite a distance, rose and landed again about thirty yards out in the river. He dived immediately and stayed under water for several minutes. He reappeared several yards nearer shore. Loons use their wings in their under-surface swimming and are speedy avian submarines. My recent charge seemed to enjoy his freedom, and gave us a

demonstration of his natatorial powers. He made many dives, sometimes seeming just to disappear while we were watching. This strange disappearing is due to the loon's peculiar ability to change its specific gravity by inhaling or expelling air from its lungs.

Loons nest on the shores or islands of fresh-water lakes and streams from Alaska and northern Canada south through the northern part of the United States. The nest is located near the water's edge, where the bird may slide into its element without having to travel over land. An annual migration takes them from their summer home to the southern states, where they spend the winter. These migrations take place in the daytime and the migration route usually follows the sea, where these shy, solitary birds may rest undisturbed.

Unlike the Canada goose, the flesh of the loon is not especially palatable. Consequently, they are not hunted, and, since they are protected by the Migratory Bird Treaty Act, their numbers have been increasing.



★ Conservation ★

A part of Nature Magazine each month is devoted to the expression of practical opinions on the vital issues affecting our use and abuse of natural resources, including wildlife, and dedicated to the purpose of assisting Americans to play a militant part in the attainment of constructive conservation aims.

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ROBERT ★★ MARSHALL

When Robert Marshall passed away in mid-November the outdoors lost a champion, the wilderness a defender. Still a young man, he had before him great possibilities; many worthy tasks, well begun, to complete. He was of distinguished parentage and had sufficient means to permit independence of thought and action in the public service. Properly to exercise his ambitions he prepared himself as a trained forester, and through exploration and study acquired an excellent working knowledge of outdoor conditions. Thus equipped, he dedicated himself to fight for the preservation of areas of primeval wilderness.

After service as the forester of the Indian Service of the Department of the Interior, Bob Marshall became chief of the Division of Recreation and Lands of the United States Forest Service. This position he held at the time of his untimely death. He was the active force in the Wilderness Society, an organization dedicated to outdoor preservation. In all his activities he spent as much time as possible in the field, hiking and climbing in his beloved wilderness. He was a mountaineer in the purest sense of the term. He knew the untouched places of the United States as few men know them. He was a writer of force and enthusiasm. His statements of wilderness values and philosophy, published in the April, 1937, issue of *Nature Magazine,* will, we believe, endure as the Magna Charta of those who feel as he felt.

The title of the division that Bob Marshall headed in the Forest Service is not entirely descriptive of its objectives. In a word, it sought to coordinate the recreational use of the National Forests in a manner consistent with the character of the areas and with a recognition of varying values. Wilderness areas were to be preserved as examples of primeval America and for the use of those with a pioneering spirit and individual capability in the outdoors. More accessible areas within the National Forests were to be developed in harmony with the environment and to permit recreational activity appropriate to a forest region.

The Forest Service will find it difficult to fill the post now so unfortunately vacant. It is faced, however, with the responsibility of a wise and careful selection of a new chief for this division. The Service owes it to the lovers of the outdoors to see that Bob Marshall's plans and policies are carried forward. This is a debt, also, to Marshall himself, and its recognition may well stand as a monument to his memory.

There is left, too, a responsibility for all of us who realize the irreparable losses that come from overexploitation of the forests and wildlife, indiscriminate road building, unwise recreational projects and the other by-products of the American mania for "development". Bob Marshall sounded the warning that "the universe of the wilderness, all over the United States, is vanishing with appalling rapidity. It is melting away like the last snowbank on some south-facing mountainside during a hot afternoon in June. It is disappearing while most of those who care more for it than anything else in the world are trying desperately to save it." We must heed this warning.

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WHAT OF GAME MANAGEMENT?

During the last five or six years there has been a tremendous growth in game management activity. It has shot up like a rocket, but whether its stars will remain as permanent fixtures in the wildlife conservation firmament, or fizzle out like those of a Fourth of July display, remains to be seen. We believe, to carry the simile out to its bitter end, that some of the stars may lose their brilliance, but that they must and will shine on if we are to continue to have our native game species.

In this issue of *Nature Magazine* (Pages 29 to 36) William M. Rush presents a penetrating discussion of game management as applied to our big game animals.

He speaks with authority born of long experience gained in the field, and not out of books alone. He poses questions that are provocative, and which game managers must answer if their theories are to function. He points to the lack of much-needed cooperation between agencies; to the absence of programs and goals on which and toward which all agencies concerned can work. He asserts that "education and not mere propaganda should have a more prominent place in the program".

We hope that this discussion by Mr. Rush, which we have felt worthy of special presentation in *Nature Magazine,* may serve as a contribution to the development of policies, the envisioning of goals, and the achievement of cooperation.

There are, we feel, two dangerous factors in game management that should be honestly recognized and, thereby, robbed of their menace. As Aldo Leopold has pointed out, in 1930 there were scarcely a dozen men devoting their entire time to building up technique in game management research and administration. Today some fifteen schools are turning out "game managers" despite the fact that less than a decade ago there were not enough men to staff these schools. Dr. Leopold feels that there has been an over-production, and we agree with him. Certainly there has been a mushroom growth. Many young men have been graduated from these schools, only to find no jobs in their chosen field. Others, who might have made better lawyers, dentists or chemical engineers, are floundering around, bettering neither wildlife nor themselves.

The second danger to the success of game management is a corollary of the first. The large production of "specialists", the long list of subjects discussed at technical sessions at wildlife conventions, the numerous and often too hasty reports that have come from game research studies, are frequently given too great weight. Combined, they tend to leave the impression that the management of our game is all taken care of; that game birds and mammals are now on a production basis and that hunting restrictions may be lightened.

Out of this development there has grown up a professional society—The Wildlife Society. This organization has already seen the danger and has urged stiffer training for fewer men. It has recognized that some of the effort now being extended by schools giving game management courses might better be directed toward educating more of their students in general conservation. It has urged higher standards of scholarship, statesmanship and aptitude among the men who are to be the leaders in formulating and carrying into effect game management practices.

The danger to the ultimate success of this movement, then, lies in a mass output whose average grade is none too high. Game management must be built on a scientifically sound and accepted foundation. This demands quality rather than quantity; clear thinking in place of blind enthusiasm.

A point not stressed by Mr. Rush, because of lack of space, is that "wildlife" research, by which we mean general studies of all environmental phenomena that affect game species, should be more generally considered. No program of management of any game species, of course, can be sound if it ignores or slights such studies. Aldo Leopold, pointing out progress of the last decade, expressed the value of general research when he said in a recent address:

"The greatest single gain since 1930 lies, I think, in the growth of detail in the idea that resources are interdependent. We knew then that you can't have healthy fish in sick waters. We knew something of the interdependence of animals and forests. But the idea of sick soils undermining the health of the whole organic structure had not been born. We had a vague notion that game and predators might be interdependent, but we lacked details as to why and how. We do not yet have many details, but we have a few.

"The clearest is the idea that browsing mammals, unlike birds, are in constant danger of destroying their own range, and that hunting alone is seldom a sufficiently delicate control to keep the herds in balance. We need predators as well.

"We had the Kaibab in 1930. We now have a hundred Kaibabs. If rifles are a sufficient substitute for wolves and cougars, why didn't they function?

"One of the most interesting 'discoveries' of the decade is that science now sees in the effects of predation the same principle which every observing sportsman has seen in the effects of gunpowder. Those who have watched game birds under fire have long asserted that moderate killing does not change next year's population. Those who have now measured game bird populations under predation tell us the same thing. Moderate loss, whether by gun or tooth or claw, simply has no effect. Many sportsmen, however, do not recognize their own doctrine when it is applied to hawks instead of guns. In predation, however, there is some kind of automatic adjustment which tends to keep losses moderate. I wish we could claim the same for gunpowder. To this extent the hawks are more civilized than we are."

We must, therefore, recognize that game management is a new science. It should not be over-sold. Its foundations must not be too hastily constructed. It must be given ample chance to prove itself, and this means it must have the continued and generous aid and support of scientist, sportsman and the general public.

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Near Wichita Falls, Texas, the state game warden was puzzled when he saw a freight train stop by the river and what appeared to be dust came flying out of the doors of the empty cars. According to the *Texas State Observer,* the warden investigated and found that the conductor made this a habit. Last winter he heard a plea that grain be set out for wild turkeys. Ever since, when he has a load of empty cars that contain grain, he has stopped, rounded up the hoboes riding the train and set them to sweeping out stray grain. About forty turkeys show up for the feast.

Things to Think About

A release from the Biological Survey records activities seeking to improve the situation of the wild turkey, Benjamin Franklin's candidate for the honor of our national bird. Pointing out that "large takes by too many hunters are in great part responsible for the scarcity of the wild turkey today", the report says that federal aid allotments in eleven states are being used to study the turkey and methods of increasing its population. Since this bird ranges relatively far from its roost, restoration of habitat is important. However, we do not find in the report any indication of plans to stay the gun for a time to allow the bird to aid in its own restoration. It is obvious, nevertheless, that some effective steps must be taken or we will have to fall back for our knowledge of the wild turkey on museum habitat groups, such as the excellent one recently installed in the Field Museum in Chicago.

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Continuing its efforts to encourage humane methods of trapping fur-bearing animals, the American Humane Association, Albany, New York, announces its thirteenth annual humane trap contest. National and state prizes for outstanding trap developments are offered. The contest closes April 30, 1940, and full details may be obtained from the Wild Life Department, American Humane Association, 135 Washington Avenue, Albany, New York.

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Loss of waterfowl through the ingestion of lead shot and resultant lead poisoning is an important factor in the complex problem of waterfowl conservation and restoration. Promise of an eventual reduction in this loss came with a report at the recent meeting of the National Metal Congress in Chicago when R. L. Dowdell and R. G. Green, research professors at the University of Minnesota, reported the development of non-poisonous shotgun pellets. Using an alloy of lead and magnesium, it is claimed to be possible to make shot pellets as efficient as the present lead ones, but which will break up within twenty-four hours in water, or on marshy ground.

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Long active in the field of conservation education, the Conservation Society of York County has made that Pennsylvania County awake to conservation issues. Its latest contribution is the publication of a pamphlet entitled *Conservation in the Rural School.* It is designed to give the rural school teacher some general suggestions that will aid her in spreading the word of conservation to the rising generation. No attempt is made to present an elaborate program, but the suggestions offered are sound and helpful. Copies are available from H. C. Ulmer, secretary of The Conservation Society of York County, York, Pa., at 25 cents a copy, coin or stamps.

In its approach to conservation, *Working with Nature* by Eleanor King and Wellmer Pessels follows a plan that seems to us to be about the best yet offered. Written for junior high school levels, this school text wisely avoids going too deeply into the details of conservation. Also, it does not assume too much background of information, and starts with simpler Nature forms to develop facts of interrelationship. Thus the authors provide a foundation of Nature knowledge upon which to build, and the importance of conservation of wildlife proceeds logically from this basic material. Too many of the attempts at conservation texts for the schools are beyond elementary and junior high school levels, and thus defeat their purpose by discouraging rather than stimulating interest. In this book we have a happy combination between natural history information and its practical significance with respect to our complicated economy today. The text is interesting and the whole book happily lacks the dullness of appearance and presentation of the average textbook. Published by Harper and Brothers at $1.20, *Working with Nature* may definitely be commended to the attention of school authorities.

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Violation of the duck hunting regulations during the 1939 season proved expensive to violators in many cases, with the courts cooperating in aiding conservation. A Virginia duck bootlegger paid a fine of $500 for the sale of two ducks from which he had removed the head, feet and feathers but which were determined to be wild ducks. In Texas three hunters charged with illegal possession and overshooting paid fines of $755. The latter were businessmen of repute in the community, if not in the duck blind.

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The first three months of the current fiscal year witnessed the approval by the United States Bureau of Biological Survey of sixty-three federal aid to wild life projects in thirty states. Under the terms of the act authorizing this work the United States pays three-fourths of the cost, and the states the rest. Twenty-three of the projects cover research; twenty-five are developmental, and fifteen provide for the acquisition of land for game management areas.

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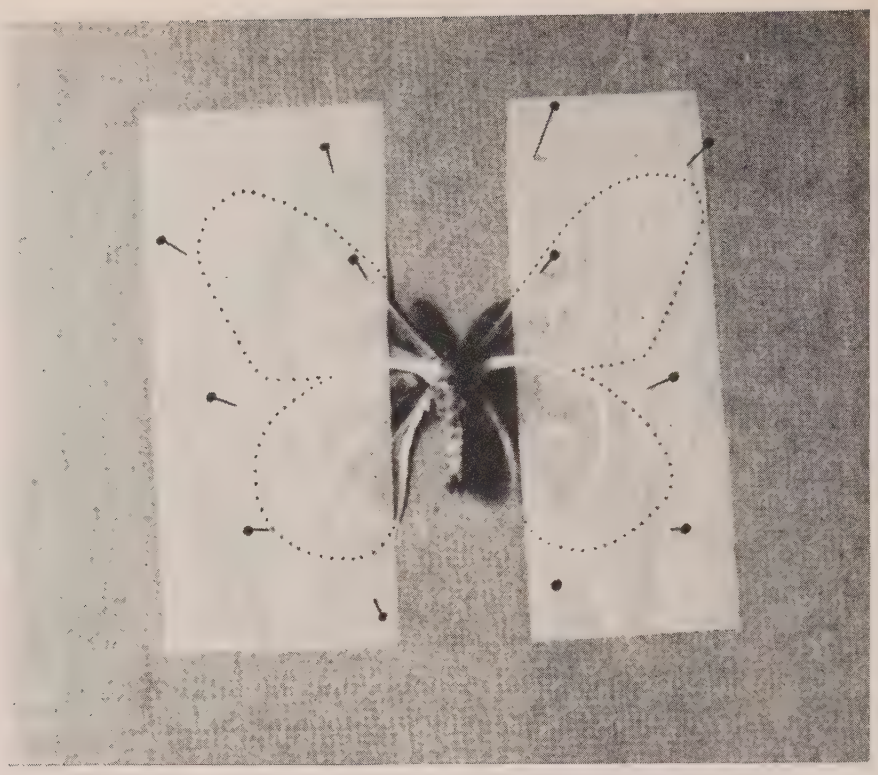
Eider ducks, black ducks, puffins and other sea-birds along the northern coast of the Gulf of St. Lawrence had a most successful breeding season, according to the report of the annual bird protection patrol carried out by the Department of Mines and Resources. The patrol covered some two thousand miles and included visits to ten bird sanctuaries.



A SPECIMEN PREPARED FOR DRYING

Butterflies and moths may thus be handled without injury to the wings and body and dried out for a week or ten days

INSECT COLLECTING

Some practical advice on a fascinating hobby

By P. B. HARWOOD

Insect collecting is a hobby that has much to recommend it. It is intensely interesting, the field is wide and specimens may be found anywhere, at any time of the year. The hobby is inexpensive, and even a large collection does not require much space. Comparatively little apparatus is actually necessary, and many ingenious devices can be made by the collector who is handy with tools.

Collecting takes a person out of doors, and hikes in the woods and fields are even more enjoyable if there is an object in view. The hunting is always good, and it is remarkable how many insects new to you will be found in familiar territory, when once you start to look. In the early spring there are the dragonflies and beetles, later the moths and butterflies. In mid-summer all insects abound, and that is also the time to collect larvae. In fall and winter the collector looks for cocoons to be kept until they hatch in the spring. Insects are so numerous that the collector can safely pursue his hobby without fear of upsetting the balance of Nature, or of reducing any valuable species to extinction. And, finally, a well-arranged and nicely mounted collection is a pleasure to own and to exhibit, and will be found of interest to almost everyone.

A good net is a necessity, and while one can be made without much trouble, purchased ones are usually more satisfactory. The bag should be of light but strong bobbinet, and should be almost eighteen inches in diameter and twice that depth. This permits the net to be doubled over by a twist of the handle, imprisoning a captured specimen. The handle should be three to four feet long, and preferably jointed for convenience in carrying it. This may seem to be large and unwieldy, but you will quickly grow accustomed to handling it. The long handle will be found useful when standing on the brink of a stream and trying to snare a dragonfly that persists in staying over the middle of the stream. The motion in using the net is a slow sweeping one, with follow-through, like the leisurely swing of a baseball bat, and not a series of erratic jabs. If you miss, on the first swing, you rarely get another chance.

Having captured a specimen, the next step is to kill it, and this should be done before it is taken out of the net. If the specimen is removed alive it may be damaged in handling, or by its own fluttering against the net. The advantages of killing wasps and bees in the net are obvious. Furthermore, a dead specimen never escapes when the net is opened. Cyanide is a standard killing agent, but it is a deadly poison, and it is unnecessary to take a chance with it. A trip or fall may result in a cut from a broken cyanide bottle, and a sudden end to collecting. Carbona, a cleaning fluid, is harmless and kills almost instantly. A drop or two will kill a pugnacious bee in a second.

A good method is to get one or two small oil cans, such

as are sold for use on bicycles, with a screw cap or cover, and fill them with Carbona. They will not leak, and can be carried in the pocket. When a specimen is captured, put a couple of drops of the fluid on its head, and it will instantly become quiet. Then remove it from the net, using care not to damage it, and place it in a tin can for transportation home. A coffee can will do nicely, as the lid is usually easy to remove but still tight enough not to come off if the can is dropped or overturned. It is a good plan to place a small piece of rag, say several square inches, in the can, and saturate it with Carbona. Then any specimens that are only stunned by the original application will die in the can without again becoming active. On a trip, another small can or box should be carried to take care of any larvae that are to be brought back alive. Any small box that will fit in the pocket will do.

A CABINET FOR RIKER MOUNTS

On top of the cabinet is a glass house in which cocoons are kept. Below, Riker mounts, the safest way of mounting insect specimens and preventing their deterioration

Equipped with the apparatus described, you are ready to start collecting. Go wherever the spirit moves you, and you will soon learn where to look for specific kinds of game. Try uncultivated fields and country roads for butterflies, dead logs and trees for beetles, and the edges of streams and swamps for dragonflies and moths.

Many insects may be attracted by sugaring. This is done by making a mixture of brown sugar and molasses, and adding a little stale beer, whiskey or asafoetida. The mixture should be thin enough to spread easily, but thick enough not to run. The worse its odor, the more attractive it seems to be. Spread it around on trees, fences, or boards, preferably about dusk, and visit the various stations every little while with a lantern or flash-light. If desirable specimens are found feeding, place the collecting can under them, and drop them in.

Another interesting method of night collecting is to hang a sheet between two trees, or over a fence, and turn a bright light on it. Automobile headlights are fine, but a bull's-eye lantern will do as well. You will be surprised at the number of insects attracted, and at the beauty of some of the little night-flying moths.

Beetle traps are easily made. Take a jelly glass, or any wide-mouth jar, and bury it in the ground so that the top is level with the surface. Put in a little meat or molasses as bait. If you use molasses, cut a piece of cardboard or blotting paper to fit in the jar near the bottom, so that the beetles will not fall into the molasses. However, even if they do, they can be washed off in water. The best catch with a trap of this kind is usually made the second or third day. Empty the beetles out into a cardboard box and select the ones you want to keep. The rest can be released some little distance from the trap. A half-dozen traps like this will give you a fine start on your beetle collection.

When the collecting trip is over, the next step is to prepare the specimens for mounting, but before doing so an important decision must be made. There are two methods of mounting insects. One is to pin them through the body and use the pin as a mounting support. The other method is to place them in cotton-filled boxes having glass tops called Riker mounts. If the first method is used, the collections may be kept in a suitable box, which may or may not have a glass cover. The bottom of the box should be lined with cork, or with two layers of corrugated cardboard, so that the pins will remain in place. The cover should be tight fitting, as there are certain minute beetles that eat dried insects if they can get at them. Boxes made especially for the purpose may be purchased from dealers in scientific supplies, and at reasonable prices.

In the author's opinion, Riker mounts are much more satisfactory. They can be obtained in a variety of sizes, the 6½ x 8½ inch size being popular, as it is large enough to hold one or a pair of the largest moths, and small enough to be readily filled by a few specimens of one species. In this size the mounts cost about thirty-five cents each, and if you have any money to spend on your hobby, this is the place to use it. With these mounts it is unnecessary to make pin holes in the insects, so that they are perfect specimens. Another advantage is that, once mounted, the specimens are safely enclosed and will not be damaged by handling. With a pinned collection, a single loose specimen may cause considerable damage to other specimens in the box, and careless handling is ruinous. Also, in adding specimens, those already mounted may have to be re-arranged or disturbed, which is not true with the Riker mounts. And, last but not least, a collection in Riker mounts is easy to store and to exhibit, and makes a better appearance than

a pinned collection when shown to interested persons.

To prepare the insects for mounting, it is only necessary to spread them out to the desired position and fasten them until they dry, which usually requires about ten days. Spreading boards can be purchased, but are not absolutely necessary. A large sheet of corrugated cardboard makes a fine drying board. With a moth or butterfly, spread the wings until the bottom edges of the upper wings are at right angles to the body, and fasten each wing there, using a pin set close inside the upper edge of the wing. Then cover both wings on one side with a strip of waxed paper and pin it down at the top, outside of the wing. Arrange the bottom wing so that it overlaps the top wing along about half of the edge, and then pin down the wax paper tightly over both wings, placing the pins through the paper only and not through the wings. Follow the same procedure on the other side of the specimen. In this way there are only two pin holes in the insect, and these will not be noticeable. It is desirable to avoid putting pins through the body of the insect, as the holes are noticeable, and the pins often stick to the body so firmly that the specimen is damaged in removing them. The antennae may be held in position by a couple of pins on each side.

FOR THE PRESERVATION OF LARVAE

This simple apparatus includes a cage in which to keep live specimens and a way to prepare caterpillars

Beetles can be dried in an open cardboard box, although it may be necessary to pin them to a drying board in order to spread the legs in a natural position. There is then less danger of damaging them in removing the pin. When the insects are all mounted on the drying board, hang it up in a safe place for a week or so.

When the insects are dry, the paper strips are carefully removed, and the insects placed in the mounts. Before doing so, it is a good plan to lift up the top layer of cotton and place a few moth crystals in the box, as these will help to keep out destroying pests. The mounts are safest where they are sheltered from excess light and heat.

There is no simple method of preserving caterpillars for amateur collectors that is entirely satisfactory. They may be kept in alcohol, but lose their color and do not look life-like. The best method is to remove the insides, inflate the skin, and dry it while it is inflated. This is not a difficult procedure, and the results are usually good. Specimens prepared this way will keep without further treatment, and may be mounted in Riker mounts. Green caterpillars will lose most of their color, which cannot be helped, but the others will be very life-like.

To prepare larvae in this manner, cut off the tip of the body at the end opposite the head, place the caterpillar on a piece of newspaper or blotting paper, and remove the insides by rolling the body with a round lead pencil or meat skewer. The skin is tougher than you might expect, and you are not likely to damage it. Next, pull the skin over the end of a drinking straw and tie it on with a single fine thread close to the end which went on first. The skin is now inflated by blowing in the straw, and must be kept inflated until dry. The drying can be helped by holding the skin several inches away from an electric toaster or hot plate. Since ten or fifteen minutes are required for drying, the blowing becomes rather monotonous, and if many specimens are to be prepared it will pay to use a better apparatus. The photograph shows a satisfactory one, which consists of a double bulb blower fastened to the glass part of a straight medicine dropper. Both items can be purchased at a drug store that carries physicians' supplies. Some form of stand can be made so that the specimen may be fastened at a suitable distance from the source of heat, and then it is only necessary to turn the specimen occasionally so that all sides are dried.

It is more interesting to keep caterpillars alive, and watch their life cycle until they have become moths or butterflies. They can be kept in cardboard boxes, as they do not need much light or air, or small cages can be constructed of screen wire. The only care required is to see that they are supplied with fresh leaves of their food plant. Detailed instructions for rearing larvae can be found in almost any book on insects. The monarch, or milkweed butterfly, is a good one to start on, as it is common, and the periods of its life cycle are short. If you find a monarch caterpillar from one and one-half to two inches long, the chances are it will turn to chrysalid form within a week, and emerge as a butterfly eleven days later.

In fall and winter many cocoons can be found. One winter day a couple of Boy Scouts went cocoon hunting in the heart of the city. They simply walked along the streets and looked in the trees at the edge of the sidewalk. In a couple of hours they found more than they could get into a cigar box. Cocoons and chrysalids may also be purchased from dealers in naturalists' supplies. They can be kept either indoors or outdoors through the winter, and in early spring should be put into some form of cage in which they can be watched. Wire cages are satisfactory, and one-pound glass tobacco jars more so. If the latter are used, fasten a piece of thin cloth over the top with a rubber band, and place a thin stick through the cloth to the bottom of the jar. The cocoon may (Continued on page 55)

WHICH GETS THE WORM, MOLLY OR GOLIATH?
The two horned lizards lunch together for the benefit of the cameraman. Usually, however, they prefer having no human audience at mealtimes and one must watch carefully to check on their diet

MOLLY AND GOLIATH

By LUCIA SHEPARDSON

Photographs by Louis J. Stellman

Once I did a cruel thing. Down in the delectable Arroyo Seco canyon I picked up a beautiful horned toad, all bright yellow and black. A friend in San Francisco had long desired one for a pet. We left for home in a few days, and the friend, delighted, wrote that she would come to our ranch as soon as possible to collect her toad. Meanwhile I fed him flies, which he ate when I was not looking. His gorgeous coloring faded to dusty brown, but he seemed quite all right.

One morning I set his box in the sun for warmth—and forgot him! After the fashion of California days in early autumn, the temperature shot up, toward noon, to nearly eighty. And direct hot sunshine for more than a few minutes at a time is fatal to horned toads not of the desert. Late in the afternoon I remembered the imprisoned one. There he was, clinging to the wire netting—such a desperate look on his poor little horny face—quite, quite dead. Strangely enough, his vivid color had come back. He was gold and black again. I almost wept as I buried him. That unintentional but none the less barbarous carelessness troubled my soul for long. I hoped I might one day find a chance to pay some interest on a debt I knew I could never entirely liquidate.

GOLIATH AND HIS SLEEPING BOX
Since he prefers warm sand into which to burrow in mid-afternoon, the box is placed in the sun during the day

Not long ago the opportunity came. We were driving when my husband exclaimed, "There's a horned toad, smack in the middle of the pavement. First one I've seen for ages."

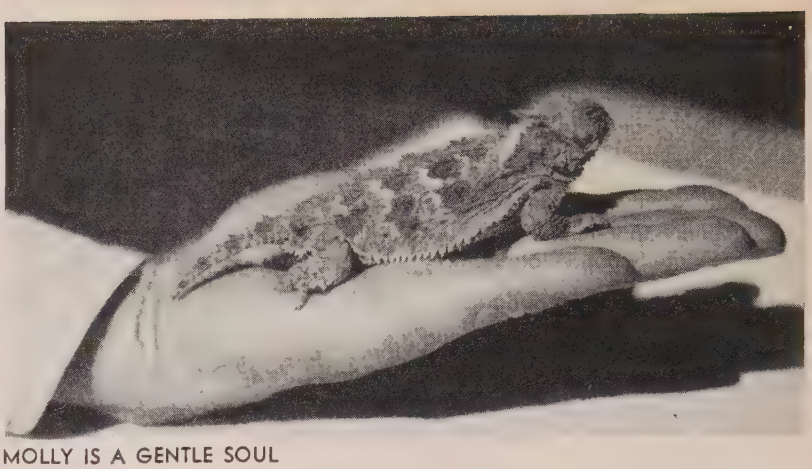
"Quick, let me rescue it, before another car comes."

A truck roared past before we could stop, and when I reached the tiny creature it was not unscathed, although still in the accustomed attitude of its tribe, head up, four feet firmly planted. The truck could not have touched it, else it would have been demolished utterly, but the concussion of heavy speed undoubtedly had hurled it violently against the macadam. Its mouth was twisted and bloody, both eyes were closed, and the toes of one front foot were bleeding. I picked it up gently. It made a whimpering sound. At the ranch I set it down carefully in the shade of a tree, where it remained motionless for hours.

Toward evening I filled the bottom of a deep carton with sand, covering the toad so that only its battered head was out. In the morning I found my charge standing on its hind feet, braced by its stubby tail, leaning high against the confining wall, hating imprisonment. That night I placed it in a shallow cigar box of

sand, and the next noon, carried it to the yard for fresh air and the healing influence of the good brown earth.

The third day I washed off its head, one side of which was unhurt. One eye, I felt sure, was closed only because of shock. The other was gone. A cut ran down slantwise from its corner to the mouth. It was healing rapidly, but the deep scar was permanent. The damaged toes were soon well. Gradually strength returned to the small creature. One day the good eye blinked wide open, after which the convalescent began to show interest in its surroundings.



MOLLY IS A GENTLE SOUL

Blind in one eye from the accident that preceded her pet-hood, she seems to realize her dependence on protection

I discovered how horned toads hunt—by standing motionless high on their legs, waiting for insects to pass their way. Ants and flies are their specialty. Often this one held its mouth wide open minutes at a time, for unwary gnats to fly in. For days I did not see it catch anything. It seemed to be rehearsing, rather than doing any actual hunting. Sometimes it watched the big ants intently, peering down at them with its one good eye like a near-sighted person.

Horned toads are not toads at all, but lizards. There are about fifteen species altogether, found in Mexico and the southwest United States. The California variety is *Phrynosoma coronatum*. They are far more responsive than most reptiles, and make charming pets. This one was no exception. It soon grew to know me, wriggling its tail with appreciation when I scratched the side of its head. One day I induced it to take a fly from my fingers, and after that it ate readily, both flies and ants. Usually they are extremely coy about eating when anyone is near.

When its head was entirely healed, it buried itself in its sand box for the night as a proper horned toad should, burrowing in head first, fore legs back along its sides. It rested five minutes or so, then completed the job by wiggling its hind feet with a droll rotary motion that carried its rear extremities completely under the sand. It began to take short strolls in the yard during the middle of the day.

One morning about the middle of June there were sixteen eggs in the sand box! My pet was no longer It, but She. It seemed incredible, she looked so small. Yet there they were, as large as a linnet's egg, with a soft membrane for covering. She showed no interest in them whatever—hunted as usual when I took her outdoors, and dug into the sand when I brought her in. Almost at once the eggs began to shrivel, and in a few days were only bits of parchment; no life in them at all.

She became a personality. A friend who loves creatures said she ought to have a nice name, such as Molly or something, so Molly she was, and is to this day.

Now Goliath enters on the scene. A neighbor telephoned she had a horned toad for me. She did not want to leave him in the orchard where she found him, because the apricot pickers, soon due, would destroy him if they saw him, or the tractor might run over him. She said he hissed like a small locomotive when she first picked him up. Molly is so gentle and defenceless I thought she could do with some hissing lessons. Also she might appreciate companionship. I fetched the stranger home in a paper bag. Half as large again as Molly, handsomely marked, with sturdy legs and a stout neck, there could be no doubt as to his masculinity. I named him Goliath.

He was turned loose upstairs, with all the fresh air and sunshine needful. For the first few days he froze whenever I appeared, remaining motionless until I left the room, when I could hear him scuttling busily about, becoming accustomed to his new surroundings. Molly paid no attention to him. When first she saw him, she walked slowly up to him, licked him twice with her quick-darting tongue, as if to be sure he were real, then deliberately walked over him as an obstruction in her way.

Goliath became tame quickly, turning first on one side, then the other, sometimes almost on edge, when I stroked his neck. He bowed his head to the floor to have the back of it rubbed, wriggling his tail to indicate pleasure. A very satisfactory house guest.

The two small creatures differ as much in habits and characteristics as any two dogs. Molly has gradually developed a voracious appetite. One day I kept count of her viands—thirty-five flies and eight ants, and she such a skinny little thing. She watches eagerly for me to feed her, lapping the flies expertly off the oak leaf on which I offer them. An occasional snack in the way of a grasshopper is appreciated, but it must be a very small one. Meal worms also are esteemed.

No kitten could be tamer. Like Goliath, she is never caged. If I am writing in my hideout, their favorite rendezvous, she comes close to my feet, wiggling her tail, coaxing to be carried down to the yard. Once there, she ambles about in a certain short radius, doing a bit of stalking, or moving to shade after a few minutes of warm sun. She never hurries. When hunting, she has a curious way of protruding her eyelids at times, the meaning of which I have not been able to discover.

Nothing, apparently, could induce her to run away.

She likes to rest in my hand, hooking her tail around one of my fingers for better balance. She pays no attention to me when digging in for the night, but dives into the sand without so much as a glance around. She never changes color, perhaps because she is of a calm temperament.

Goliath is not so tame, although apparently quite content in the house. He runs like a streak across the rooms for exercise, with a comical shimmying motion of both hind and front feet simultaneously, his body and tail well off the floor. If I turned him loose outdoors, like Molly, he would be gone in a flash. When the prune harvest is over, I shall give him his freedom. I shall miss him. He eats readily, but not nearly so much as Molly. He stalks his prey like a cat, sneaking up on it and pouncing in a most feline way. He beats a grasshopper on the floor to kill it, and swallows it with many gulps and contortions. His bright eyes miss nothing.

He looks all around cautiously before going to bed, making sure that no person is near. When I first got him, I noticed that about three in the afternoon, the usual retiring time of horned lizards, he was restless, hurrying from room to room, poking into corners, never still a minute. When I put him in his box, he bounced indignantly out, glaring at me over his shoulder as he scurried away. Something was troubling him, but what? Then it occurred to me that he hated going into the cool sand of his apartment. The earth is warm when they dig in, outdoors, about the middle of the afternoon. His sleeping box was not warm, and he did not like it. So I set his box, and Molly's also, in the sun all day, until they were heated through and through. Both occupants noticed the difference at once, with much appreciation. Goliath now turns in at the usual time with entire willingness, for his bed is warmed daily.

He is a beautiful specimen of his kind. Larger than the usual California species, his body is not slender but round as a dollar. His tail is much shorter than Molly's. His coloring is far more striking. His horns are dark red, the three irregular stripes across his back are dark red, as well as the patches on the sides of his neck. Along his sides are orange shadings. Poor plain Molly is mostly tan and dusty brown. Both are yellow underneath, splotched with gray. When agitated, Goliath becomes much lighter, almost beige. Sometimes when he first gets out in the morning, he is much darker than during the day. I have never heard him make any sound.

As with all creatures of the open, patience and time are necessary to win the confidence of horned toads so that they are really pets, not just unhappy captives. But it is more than worth the effort. Molly and Goliath are cherished friends. Have I atoned, ever so little, for what happened to my pet from Arroyo Seco? I like to think I have.

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A Killdeer Nest

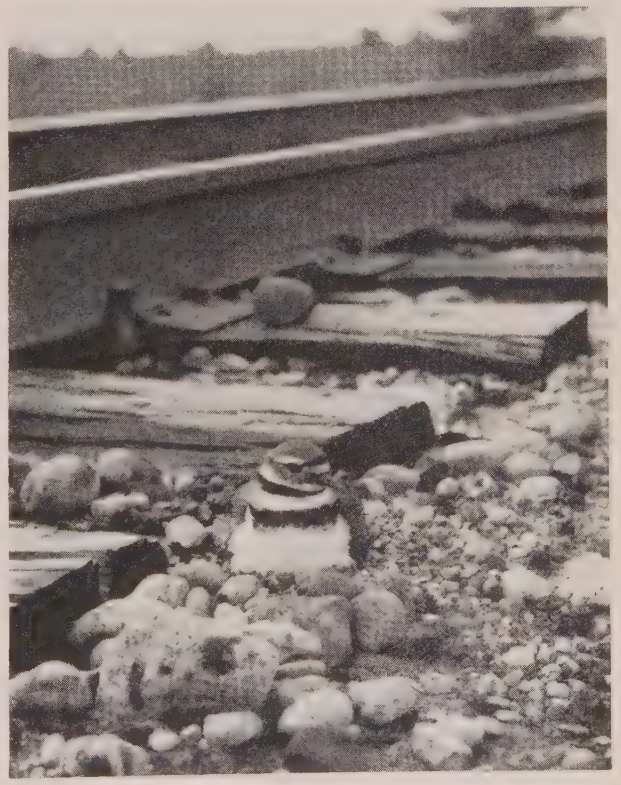
By ENOCH REINDAHL

Photograph by the Author

IN ADAPTING themselves to life in fairly close association with man, many of our wild birds have selected odd and hazardous sites for their nests. Many, for this reason, fail to raise their families, but others miraculously succeed against what seem to be great odds.

Killdeers seem particularly to seek to raise their families under conditions where the odds are heavily against them. In the photograph we see one such instance. We can only speculate what the feelings of the bird must have been when the train thundered by. We can only wonder whether the parent left the nest each time trying to lure the snorting and rumbling monster away from the nest as it would an intruding animal.

Even though this nest of this member of the plover family does seem especially endangered, it may have proved better than a site in a cultivated field or pasture. In such places the menace to the nest lies in the passage of farm machinery or from the trampling of the farmer's cattle. Then, too, the gravel bed of the tracks affords good drainage in case of heavy rains, and the bird and the eggs blend



so well with the surroundings that only the sharpest of eyes are able to distinguish them from nearby stones.

Anna Botsford Comstock

By MIRIAM OTT MUNSON

Illustration by Jex

ANNA BOTSFORD COMSTOCK
1854—1930

RECENTLY, a well-known littérateur upon receiving his honorary degree as Doctor of Science informed his listeners that: "Nature has become bankrupt and is no longer a source of poetic or human inspiration."

While this generality, like many of its kind, will not bear careful scrutiny, it is somewhat terrifying to be told that Nature, the ever-young, the ever-fair, the ever-miraculous is about to fail us and that even our poetry will have to be expressed in mechanistic, materialistic and abstract terms in the future. It is also, fortunately, revivifying to recall the illustrious woman who was dean of Nature study in America for the more than fifty years of her distinguished service at Cornell University, who spoke and wrote with scientific accuracy, whose poet's appreciation of Nature's beauty enabled her to recapture for others the rapture of her heart, and whose artist's perceptions were so finely and delicately assembled that she was able to represent the texture of a butterfly's wing in those wood engravings that she made with her own hands to illustrate her own and her illustrious husband's entomological works.

Nature, and an appreciation of Nature in all her moods and phases, was the life preoccupation of Professor Anna Botsford Comstock, who was known at the time of her passing, August 24, 1930, at Ithaca, N. Y., as the outstanding authority on Nature study.

Nature never became sterile for Mrs. Comstock. Born on a farm called "Hilltop" in Otto Township, New York, in 1854, she was, in 1923, counted one of the twelve most famous living women. Can it be that her world recognition came to her because she viewed, always, the variety and beauty of natural phenomena with a poet's heart and a scientist's eye? This response of her heart to Nature and her scientific observation of it she embodied in a textbook that has become a classic in its field, and is frequently and appropriately referred to as the "Bible of Nature Study."

Coming to Cornell in her young years, and almost at the University's beginning, Mrs. Comstock championed the new subject of Nature study and quickly made her artist's appreciation and her scientific knowledge felt, not only in the University but, through the later years, to tens of thousands of boys and girls in New York State and elsewhere, by means of the Extension Department of the Cornell College of Agriculture and her published works. She used to say, "It is Nature that makes us so satisfied with our surroundings be they meager or opulent."

None who heard her last public address will ever forget how she carried this theme through her whole life. Although shattered in health and well past her seventieth milestone, this distinguished yet simple-mannered woman radiated a buoyancy of spirit and a sparkling zest of thought that blew over her eager audience like a fresh morning breeze from a rain-clear, wind-swept sky. It was as if she wished to impress her listeners with the fact that—as she said—"Nature is the nearest thing to a natural setting that man will ever have, and it is to her that man must look for his fullest joy and re-creation."

It was as though she desired to leave with her audience

of scientists, rural teachers and Nature lovers from far and near the memory of the lovely and natural way Nature, herself, had started her beloved daughter on her life's career, and how those beauties that surround a child on a farm had aroused her child's interest and pointed the path to her future life, so rich in beautiful memories and beautiful things accomplished.

"From the time I was three or four years old," Mrs. Comstock said in her vibrant, musical voice, "I knew and saw everything within my range of vision. I loved the birds so much; they attracted me by their flight and varicolored plumage. Sometimes at sundown I heard the thrush's song; I did not know that bird's song by name, but the thrush's song was in my heart though the name was not in my head.

"I loved the woods and fields and roamed them all to find the harvest of their treasures, from the partridge berries in March, through the abundance of the changing seasons to the dried grasses of the fall that adorned our 'what-nots' in December, when nothing could be plucked and brought in from the out-of-doors. Do not smile at 'what-nots' with their dried grasses, my friends. It was the memory of a summer gone they held; I lived it all and loved it all!

"And though at six," she told us, "I knew the names of forty birds and sixty flowers, it was not a flower or a bird that first aroused my childish interest and eager determination to know by what names these lovely things were called, which I came upon in my daily wanderings in woods and fields. Walking one day with my mother through the wood I suddenly saw a purplish-blue, sticky, glistening little bulb that was tipping the long green end of a pine branch. The surprise of its being there attracted my child's attention by its unusualness more than anything I had previously observed. Eagerly I questioned my mother, who could tell me only that it was a new baby pine cone. Yet, somehow, that single purple pine cone glistening in the sun before the eyes of a little girl of few years was the magic key that opened the door to all the vast realm of Nature's marvels for me."

It was the pine cone hung in the gallery of her childhood's memories of beautiful natural objects that made her, in later years, feel that there are so many beautiful things on a farm that children must know about, and that "life on the farm would be so much richer and finer for the farm child if he only knew what was there."

"I always look back on my childhood," she said, "as having dwelt for a space of time in an enchanted land and I am deeply grateful to my Quaker mother for all she did to fill my mind with the love and appreciation of field and wood. But as the years went on, and I took up the study of Nature in earnest, I felt that children must have even more knowledge than the average parent can supply: knowledge that is scientifically correct, poetic, too, and so clearly expressed that even the youngest child can read and understand. And, since all great art takes its form from the natural world, I felt that children should be imbued with the artistic and creative possibilities that lie in the simplest seed or flower."

This thought took form later (1904) in a book, just for children, which Mrs. Comstock titled *My Own Book of Three Flowers That Blossom in April,* and its twin, *My Own Book of Three Flowers That Blossom in May.*

Not only the desire to make life on the farm more lovely for children and more productive for them when grown, but a still greater urge impelled her "to work for the introduction of Nature study in rural, and, indeed, city schools." The crystallization of her purpose came with the "panic of 1894, which revealed the disastrous effect of the drift to the cities."

"I felt," she said, "that children could be kept on the farm by making them interested in the problems of the farm and the place to teach them was in their own rural schools. Everything learned by a child about Nature can be used later in his life as a farmer. Such a study will interest the child in the farm as a place. He will know what makes the brooks rise in the spring; he will learn about the different soils in the fields, the woods and the pastures, and can bring samples of the soil to school and have the teacher label them and explain how many varieties of soil there are, and what soils nourish the various trees, grains and flowers that grow in the forest, the fields, the meadows and his own door-yard.

"All children love stories, and everything on the farm has a fascinating story of its own; the tale of Cinderella is not more surprising and delightful to a child than the story of a butterfly. The plants, all of them, have their individual stories—how they grow, and why, and where; the mysterious processes of cross-pollination—a subject of vast importance to the farmer—as in the squash and pumpkin, and all the other processes by which Nature gradually changes her species. How fascinating for a child to know that Nature never uses the same pattern twice.

"The farm child can learn not only the charm of flowers—their amazing varieties and colors—but the reciprocal relation between them and the blessed helper, the bee, and how she is diverted to different plants by the planting of flowers that most attract her. Such a widening of a child's horizon, by revealing to him the mysterious treasures at his own doorstep, will teach him to think creatively, and may, by showing him how to work with Nature, enable him in his later life as an adult farmer to produce something not known before.

"And then there are the birds, they are a whole world in themselves. The farm child can become acquainted with them; what birds there are on his farm and in his woods; what they are doing; are they helpful or not? Too, the farm child can find out a great deal about the other tenants of the farm—the animal tenants and the insect tenants; how many there are; what their habits are. And he should know whether they are enemies or friends to him. For there are almost as many insects in the garden that are helpful as there are species harmful to plants. This observation of his natural companions and all the expressions of Nature about him make a child feel that the earth is his heritage, and, by becoming familiar with his own domain, he insensibly becomes master of it.

"After all, successful agriculture is learning how to use

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the laws of Nature and not to thwart them. Nature's laws are immutable, but man can use them for his own good. Science teaches the child, and later the man, their use."

As she poured out the riches of her life's experience it was as if this great personality, with her intense love of Nature and humanity, wished to leave some great urge in the minds and hearts of her audience that they might continue her work when she was gone from it. She seemed to wish that the men and women to whom she was speaking might feel that this world is theirs and their children's, and that the "Creator would not have filled it with such abundance and beauty if it were not meant that we should enjoy it at its fullest."

She urged her listeners to help the child recognize the beauty of the world and so add to the happiness of life in his maturity, saying, "It is this feeling of having been born into a world that is beautiful that we must foster in our children, not only because Nature's beauty is the only abiding compensation for the disappointments that life inevitably brings us all, but because the very study of all her lovely forms and expressions enlarges children's vision and helps them to lift their minds and souls up as high as the stars, and makes them reverent.

"By teaching our children the divine beauty in the world they may learn to transmute it into beauty; they can even make beauty, and the number of points at which one is able to do this is the measure of our successful living. And when we teach children the scientific facts, the art forms, and the poetic intimations of Nature and her magical realm, we live again, with them, our childhood's adoration and glad surprise at having been born in a world that is beautiful; and we, too, touch with them 'that faith which nothing can destroy—the earth, the living church of ancient joy.' "

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THE REALIST

By MARIE E. KRUSE

Today Frau Holle, as 'tis said,
  Is shaking out her featherbed.
The feathers drifting gather deeper,
  I'd say that she's a poor housekeeper!

(Frau Holle, lest you do not know,
  Is the German fay who makes it snow.
While shaking out the clouds—her bedding—
  The feathers fly, and *we* have good sledding.)

•

Patience with a Plover

By OSWALD F ZAHN

JUST INLAND from the roaring waves on the sandy stretches of ocean shore at Mission Beach, California, a snowy plover sat serenely over a heel-print in the sand. Underneath her lay three large eggs. Although this wild bird fled upon the approach of a person still a hundred yards away, I was able, after several visits, to creep right up to her, and, reaching over to my camera, to snap pictures of both of us.

When my hand approached too close, however, she would flutter her wings and peck and scold as if to say, "Now you are going beyond all reason." On one occasion a small flower was stuck up near her nest. After many close approaches, her mate finally made a decided dash, snapped up the flower and in a business-like manner trotted away with it.

Although at one time my face and the camera were both within eight inches of this wild bird, and I was talking to her and changing films and taking several pictures, she did not leave her nest. The approach was made by creeping a little closer each time she left her nest. Often some movement on my part was necessary to induce her to leave. Then she would flutter about as if wounded, trying to entice me to follow. When I paid no attention to this trickery, she would return to the nest, look at me quizzically, as if to ask, "Were you really that close before?"

To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south.

THE HEAVENS IN 1940

By ISABEL M. LEWIS

DURING the coming year there should be an appreciable drop in solar activity and the frequency of occurrence of great sunspot groups, together with all their attendant phenomena, such as magnetic storms, radio fadeouts and remarkable auroral displays. The sunspot maximum of this cycle, which reached a peak in 1937-1938, when some of the largest sunspots on record were observed, is now definitely passed.

There will be two fine central eclipses of the sun this year, one annular and one total, but there will be no eclipses of the moon.

The annular eclipse of the sun, which will occur on April 7, will be visible over all of the North American continent, with the exception of Alaska, and the path of the annulus will cross Mexico and the Gulf States. Chihuahua in Mexico, and Austin, San Antonio, Houston, New Orleans, Baton Rouge, Pensacola, Tallahassee and Jacksonville are some of the cities that lie in the path of the annular phase and will thus witness this event.

This type of eclipse occurs when the relative positions of the sun, moon, and earth are such that the moon does not completely cover the sun at the time of greatest eclipse and a ring, or annulus of light, may be seen surrounding the moon. In some eclipses this ring of light will be so thin that the eclipse will be almost total, and the duration of the annular phase only a second or so. Such an eclipse occurred in April, 1930. This was a total-annular eclipse and was barely total for a second or so in California and Idaho, and annular in other portions of its path. In some annular eclipses the ring of light will be quite wide and the duration of the annular phase may then be much greater than the maximum possible duration of a total solar eclipse, which is about 7 minutes, 30 seconds. An annular eclipse may last for more than twenty minutes.

The eclipse of next April will have an annular phase lasting, at the most, about 7 minutes, 31 seconds, in the Pacific Ocean, over which more than half of the path

passes, but its longest duration on land will be slightly less than seven minutes in Mexico. At Baton Rouge the annular phase will last more than six minutes. In general annular eclipses have been considered to have no scientific value. This can no longer be regarded as true, for some valuable observations are now made during large partial and annular eclipses, as well as during total eclipses, to determine the effect of solar radiation upon radio transmission. A number of such observations will undoubtedly be made during the annular eclipse of April 7, as well as during the total solar eclipse of October 1, 1940. This latter eclipse should be one of unusual scientific interest and value as it is of long duration and may be seen favorably in Brazil and South Africa.

The office of *The American Ephemeris* and *Nautical Almanac*, at the U. S. Naval Observatory in Washington, D. C., has prepared a special eclipse supplement on the subject of this eclipse, with large-scale maps of the region covered by the eclipse in South America and Africa. Several scientific expeditions may be sent to observe this eclipse in Brazil, but war conditions abroad may prevent the dispatch of expeditions to South Africa.

The eclipse of October 1 begins at sunrise off the northwest coast of South America, and the path of totality, after crossing the Andes and the Amazon valley, passes over the northeastern part of the Brazilian plateau. Conditions there are most favorable for its observation. The path passes to Pernambuco, or Recife, on the east coast, and from there crosses the South Atlantic to the west coast of South Africa, about one hundred miles north of Cape Town. The town of East London, on the east coast, lies in the path of totality. The Great Karroo and the High Veldt, over which the path passes, offer some excellent sites for observation under favorable weather conditions. The eclipse will occur in the early morning in Brazil and in the late afternoon in South Africa. The duration of the total phase at Pernambuco will be nearly five minutes, and at favorable locations in South Africa about a minute less. The maximum duration of the eclipse will occur in the South Atlantic in longitude about 18 degrees west and latitude about 18 degrees South, with the sun near the meridian. At this point the sun will be totally eclipsed for 5 minutes, 35 seconds.

There will also be, this year, a transit of the planet Mercury across the disk of the sun visible on November 11-12. In the United States the sun will set with the planet on its disk, but in the Pacific Ocean and Australia the entire transit of the planet across the sun's disk will occur with the sun above the horizon and will last for more than five hours. So small is the planet compared to the sun that it will not be possible to see it projected against the sun without the aid of a telescope. Observations of the planet at that time will be valuable for testing the accuracy of the predictions of the planet's position in its orbit.

There will be two interesting occultations of planets by the moon this year. An occultation of Venus by the moon will occur on July 31, and will be visible in the central and western part of the United States. Although it will occur in the daytime, the brilliancy of this planet is so great that it can easily be seen in broad daylight. An occultation of Saturn will occur on June 30. This may be seen in broad daylight, with the aid of small telescopes, in the western states.

Mars, which was at one of its close oppositions in July, 1939, when it came within 36,000,000 miles of the earth, is now rapidly receding from the earth. At aphelion, on August 25, it will be at its greatest distance of 248,600,000 miles. It will be in conjunction with the sun on August 30, when it will pass from the evening to the morning sky. It starts the year in Pisces, still a brilliant object in the evening sky, close to Jupiter, with which it will be in conjunction on January 7. During the year it will pass through eight of the zodiacal constellations in turn, and at the end of the year will be in Libra.

The planets Jupiter and Saturn will be in the same part of the heavens throughout the year, remaining in the constellations of Pisces and Aries. Mars also will be in Pisces, or Aries, until March, and will be in conjunction with Saturn on February 13. Jupiter will be in conjunction with the sun on April 11, and Saturn will be in conjunction on April 24. During the next few months Jupiter draws nearer to Saturn in the morning sky, until, on August 6, they come into quadrature with the sun, only one hour apart, and are in conjunction with each other on August 15. They will again be in conjunction on October 11 and will be in opposition to the sun on November 2-3, only 17 hours apart, in the time of opposition.

Mercury and Venus, whose orbits lie within that of the earth, are seen to the best advantage near the times of their elongations, when they are farthest east or west of the sun. Mercury's orbit lies so close to the sun that the planet cannot be seen at all with the naked eye, except within a week or ten days of the dates of its elongations. The most favorable time for observing it in the evening is at eastern elongations that come in March and April, and it is best seen in the morning at western elongations of September or October. In 1940, Mercury will be at eastern elongation three times, on February 28, June 24, and October 20, respectively, when it will be visible in the evening twilight. Its western elongations will occur on April 12 and November 28, when it will appear in the morning twilight. It will be in superior conjunction with the sun on January 31, May 21, and September 4, and in inferior conjunction on March 15, July 22, and November 11. On the first three dates the sun will lie directly between the earth and Mercury, and on the last three Mercury will be between the earth and sun.

Venus will start the year in the evening sky and will remain there until June 26, when it will be in inferior conjunction with the sun and pass to the morning sky, where it will be for the remainder of the year. It will have its greatest brilliancy in the evening sky on May 20 and in the morning sky on August 2. It will be farthest east of the sun on April 17 and farthest west on September 5.

THE CLOUDED LEOPARD

(Continued from page 24)

have driven them from the lowlands to the little-known interiors. Their only human neighbors are aborigines, headhunters and cannibals.

Difficult terrain, hot climate, torrential rains, contagious diseases, native unfriendliness, superstitious beliefs, scarcity of numbers, and uncertain habits have discouraged their pursuit and left that occupation a native monopoly. The native traps and methods of trapping have never been described and this subject remains one of the many secrets pertaining to the mystery of this cat's existence. It is, then, quite obvious that if these leopards are ever collected in sufficient numbers, sexes, ages, and varieties, to satisfy popular demand and scientific study, methods of search and pursuit will have to be initiated differing from those employed in the collection of lion and tiger trophies, and different from those known or pursued by natives at present.

INSECT COLLECTING

(Continued from page 46)

be left in the bottom of the jar, and may be hung from the stick. In either case, the stick gives the moth a support to cling to while the wings are expanding and drying. If you have one of the miniature glass greenhouses that are used for winter gardens indoors, cocoons can safely be put in to hatch. Butterfly chrysalids, however, are liable to be destroyed by the dampness.

Nothing has been said so far about insect study, but if collecting holds your interest, the studying will almost take care of itself, and it will be surprising how many facts you will accumulate as you go along. A good reference book is invaluable as an aid in identification of specimens, and for information on their habits. It will help you to answer such questions as whether two similar moths are related species, or male and female of the same species, what the food plants of the different larvae are, and what kind of butterfly will result from a particular larva. The *Field Book of Insects* by Frank E. Lutz is a mine of information in a small space, and is written so as to be easily understandable to an amateur. If you live in a city where there is a public museum, much information may be obtained by comparing your specimens with those on exhibit, and museum officials are usually glad to help you find the answers to questions that puzzle you. Of course, pinned specimens are easier to compare than those in Riker mounts.

The Garden's Past

Every flower in your garden has a past. Unlike many human pasts, they can stand scrutiny. In fact, such study is fascinating and lends greater interest to your garden flowers. Hence garden lovers will find most charming an attractive book entitled *Where DID Your Garden Grow?* Written by Jannette May Lucas, and illustrated in color and black and white by Helene Carter, this book delves into the history of plants and reveals many surprising things. Published by J. B. Lippincott, the book sells for two dollars.

INDOORS AND OUT

(Continued from page 7)

would have written on other subjects. "This science," he says in *Flowering Earth,* "carried away a mind that had been encouraged so far chiefly to intuitional judgments and emotional understandings." Mr. Peattie has written a great deal of his own life story into this book, and it thus has an added importance. There is no doubt that his training in the Gray Herbarium and his experience as a botanist have to a great extent disciplined his exuberance, but it is plain that his genius still fortunately lies in "intuitional judgments and emotional understanding". We read him not for instruction but for inspiration and for the privilege of sharing the enthusiasm he has the power in words to create.

It is certainly a reassurance to us in our obsession with the outdoors to realize the significance of the fact that both the scientific mind of Dr. Mangham and the artist in Mr. Peattie have found such complete expression in discussing the earth's plant life. Those who will have the opportunity that I have had to read *Earth's Green Mantle* and *Flowering Earth* on successive week-ends will prize an enrichment in both information and inspiration. They will sympathize with Mr. Peattie's allegiance in testifying: "There are always some of us, not a few, in every generation, who go over wholly to the green flag." They will understand why Dr. Mangham writes: "It has been said that 'The proper study of mankind is man,' but it might with equal truth be urged that 'The proper study of mankind is vegetation,' since without plants there could be no men!"

New Year's in a Swamp

Florence Page Jacques had more difficulty in accommodating herself to camper's hardships in the Mississippi bottomlands than one would expect after reading her enthusiastic *Canoe Country,* but in the heart of the Louisiana marshes, on the Audubon Societies' Rainey Wildlife Sanctuary, after she had "resisted this land of half-submerged loveliness far longer than any other," she was conquered by a sunset. "This too," she decided, "would be my country."

Her new book, *The Geese Fly High,* is full of human interest in a woman doing her best to keep an outdoor husband company. Despite the sunset's conquest, one believes that she would still hold to her earlier conclusion that "New Year's Eve, of all festivals, should not be spent in a lonely cypress swamp," and most of us will sympathize with her fully. Her book, published by the University of Minnesota Press at $3, is an excellent description of the wild fowl country that she saw in the lower Mississippi region, and especially of the sanctuary she visited. There are forty illustrations, in addition to the excellent end papers, by the author's husband, Francis Lee Jacques. So nicely balanced is the work of the two collaborators that it is impossible to say either that the illustrations are for the text or that the text is for the illustrations. They go together. Coming after *Canoe Country, The Geese Fly High* whets one's appetite for a series of such books, and one hopes that Mrs. Jacques is not dismayed. It hardly seems likely that she is. —H. Z.

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THE SCHOOL PAGE ★★★

EDITED BY DR. E. LAURENCE PALMER

Professor of Rural Education, Cornell University, and Director of Nature Education, The American Nature Association

Anent Winter Field Trips

A standard professional text in elementary education says of field trips that they should be taken *only* when children have a felt need of them; that the children must be conscious that they lack clear-cut precepts and accurate notions of relations and sequences; that the children must have detailed directions of what they should do on the trip, preferably mimeographed, and that there must be time provided to guarantee that everything is recorded appropriately and everything significant really appreciated.

This reminds me of a facetious account of such a field trip in which a rabbit was chained to a tree, and a gun set pointed directly at it so that all the child had to do to really enjoy the trip was to pull the trigger and see the rabbit die. A field trip may be such a natural experience that it is a shame to have it completely ruined by too much organization. Recalling the last half-dozen field trips I have taken, I am sure that it would have been impossible to have planned for the most important experiences. A family of loons off a lighthouse pier, a mating pair of fall cankerworms, a female crayfish with eggs, a red fox freshly killed by an automobile, are not field experiences for which one can make specific preparation and for which the teacher can issue mimeographed material in advance. Neither can the teacher be sure that the children have, in advance, a felt need for the information that may be acquired. As a matter of fact they may have no such felt need and yet the experience may be highly profitable.

The writer entertains no belief that all teachers are ready to take pupils on a profitable field trip on the spur of the moment, but they should at least be making progress in that direction during their training period and during their years of teaching. One of the best ways to get this ability is to go on field trips with one's eyes open no matter what the weather. If teachers spent one-third of the time they spend sleeping over books in libraries walking in the open fields and woods trying to learn about what they see there, they would soon gain sufficient ability to make their company on a field trip a pleasure.

At a recent meeting of the Conference on the Education of Teachers in Science the host apologized for not having a field trip because the weather was so bad. As a matter of fact the weather was perfect. The front yard was well-populated with a flock of migrating juncoes. A mocking bird called in a tree in the side yard and the trees, many of which were strange to some of the visitors, blazed color all about. What used undoubtedly to be an attractive gorge had been "stream-lined" so that its banks all sloped evenly and smoothly under a carpet of myrtle, but some splendid rock exposures still remained uncovered. Some gully erosion had begun on one bank, and even though a pool had been completely cemented in and populated with aquarium aquatics still the surface was dimpled by some water-striders and a few other native things survived. Why do we have to put everything into mimeographed outlines, concreted pools and sod-covered banks? We print obituaries about people who die and are buried in concrete vaults under the sod, but why try the same treatment on the livest part of the school curriculum?

Agassiz said at the beginning of his summer school at Penikese, "I shall never make you repeat what you have been told, but constantly ask you what you have seen for yourselves". That is the essence of the field trip. More recently, the pedagogue Fitzpatrick said, "There is much to be said for associating fieldwork with work in ecology"; while the scientist, Kinsey, says, "there is no limit to the fieldwork" that may be done here.

One way to learn how to take field trips is to take field trips on your own. Take them only a few feet from the front doorway, if necessary, but take them. It is said that Asa Gray could spend a whole afternpon on a field trip over a part of his front lawn, but a college biologist was recently heard to complain that field trips were no longer possible because all the wild places had been improved. A college paleontologist spends the whole year with his classes in the laboratory, except for two trips to distant points, although there are superior and classic fossil beds within a half mile of the laboratory. A western New York high school is built in a quarry which is a famous Eurypterid bed, and yet no use was made of the fact in the science classes taught in the school. Somehow teachers at all levels seem to be insanely afraid of seeing Nature in the raw.

This article is written for a winter number of *Nature Magazine* to suggest that teachers generally begin to see what can be offered in the fields at this time of year. If the study is with animals there are better mammal records on the snow than can be found at any other time of the year. If the study is with plants, why not begin to notice the silhouettes of winter weeds above the snow, and the seeds and fruits that they bear and which serve as food for birds? If the study is meteorology, what about the variation in the sizes and shapes of snow crystals; the work of ice in breaking rocks; the physics of a snow drift; the temperature inside and outside a drift; the reason for its shape, or the influence of shade on its speed of melting? Forget the generalizations and big ideas recommended by one group of educators and get some first hand experiences in sufficient abundance so that the generalizations will take care of themselves.

I have no serious quarrel with those who would organize their work, or who recommend that the students reach generalizations, but organization and generalizations are dangerous masters, and, unless watched, may completely ruin a most virile method of learning. There is much evidence that they are doing just that to science at all scholastic levels.

Now for a few places which, in winter, should yield valuable field experiences.

The fencerow. Fences show all sorts of interesting things. The clean wire fence with no shrubbery does nothing to slow the wind. As a result the fields may be blown clean of snow and the loose top soil dumped on the first hollow where the snow has a chance to settle. Is this the sort of place where rabbit tracks abound? Do the posts serve as perches for birds of the preying type? If snow is deposited is it deeper close behind the posts away from the wind or between the posts?

If the fencerow is shrubbed, are the shrubs accompanied by weeds? Are bird and rabbit tracks more common in the snow? Do preying birds perch commonly in a shrubby area? Is the snow deeper on the side towards the wind or away from it?

The brook. Brooks that are spring fed may vary their temperature less during the winter than those fed from surface waters. Why is this so? Is this obvious in local brooks? Which of two brooks of different types is likely to remain open the longer?

Dig up some masses of leaves on the creek bottom and put them into a pail. Do they yield many forms of life such as were shown in the aquatic insert in *Nature Magazine* (Oct. 1938)? Are any or all of these insects killed by being frozen into the ice? Are fish killed by being frozen into the ice? Are all fish alike in this respect?

Notice that the water of a running brook may be laden with slush and small pieces of ice. Is there any evidence that this tends to remove the ooze and slime from the exposed surfaces of submerged rocks? Can you notice where the highwater level was on the rocks last summer because of the distribution of the ooze on the rocks now submerged? Are insects ever found under rocks in streams as they are sometimes found under rocks on dry land? Watch the snow banks in early spring for some insects which may emerge from streams and crawl out on the snow to breed.

The dead stump and fallen log. If one must disturb dead stumps and fallen logs in winter they should be put back into place after they have been investigated. Here is the place for spiders, snails, the nests of some kinds of mice and squirrels, the food caches of other animals, the larvae and cocoons of many kinds of moths. When some of the animals found here are brought into a warm room they renew activity. At what temperature do the different creatures available for study become active? Is the temperature inside, beneath and on top of the log or stump the same? What parts, if any, of a stump or log are dry and is this part apparently sought by particular creatures for a suitable shelter? Does light seem to be of any importance to animals living sheltered by a log or stump?

The evergreen forest floor. Here may be a dense mat of needles with little opportunity for sun, and, as a result, a persistent snow blanket. Under the snow and needles may be the burrows and nests of mice and insects, and there may be evidence in the snow above that these are sought by skunks. Is there evidence of a greater abundance of food near the edge of such a woodland or deep in the area?

These are merely some of the things to look for on a winter's field trip where the

snow covers the ground. Ann Morgan has recently written a splendid book dealing with winter problems in natural history. Put such a book under your arm and go into the open no matter what the weather may be. Study, on the ground, what you can, and if it gets too uncomfortable bring some things home for further investigation. But do not expect that you can get the most out of this or any kind of field trip by planning it all in advance and having a mimeographed sheet that will show your children just the spot from which the rabbit will leap.

Don't worry if your companions, whether they are children or adults, have a "felt need" for the specific things you find on such a trip because nine times out of ten they will not. And ninety-nine times out of a hundred you could not tell in advance all the things you would find on a trip unless you were blind to everything except what you may have read in a book or to what someone may have shown you. There may be a science of teaching how to do a specific set of procedures in a controlled laboratory, but there surely is more of an art in teaching in the field. Frankly, I think good teaching is more an art than a science anyway. And this does not mean that it is something to be ridiculed. Science may help perfect some of the machinery of teaching, but art will make it a living, functional activity.

CAMERA TRAILS

(Continued from page 3)

outside that angle of view shines on the lens. This extraneous light may be spread over the whole negative in a sort of gray fog that dulls and flattens our print. Its effect is less than that we see when we have accidentally included the sun in the picture, but it is more than enough to spoil the crispness of a good negative. The cure is a shade that will not cut off any of the picture but will come as close to the edges of the negative as possible and extend out an inch or two in front of the lens. For most small cameras they may be purchased for a dollar or so, and for larger cameras we can easily make one, but our pictures will be better no matter where they may be made if we use a shade for every exposure.

There are a number of other often-asked questions, but The Editor will probably want to run something else in this month's NATURE MAGAZINE, so we'll take them up later. If you have some question that might be of general interest, send it in. Maybe it will help you and others too.

This and That

The Eastman Kodak Company of Rochester has brought out another in its helpful series of booklets entitled *Kodak Lenses and Shutters*. It sells for 15 cents. Whether you use an Eastman lens or not, you will find a lot of valuable information in it. If your dealer does not have it in stock, write to Eastman for your copy enclosing the 15 cents.

Another booklet that will help all of us is the new instruction manual issued by the Royaltone Laboratories of 37 West 57th Street, New York City. It explains the causes of many of our failures. Your copy will be sent to you free if you will mention Camera Trails when you write for your copy.

Perhaps the most useful handbook for any of us is the familiar "Wellcome" issued each year by Burroughs-Wellcome and Company at seventy-five cents. It contains the latest information on films and papers and a host of other assistance in addition to the exposure calculator in the back pages. Probably no other publication is as widely used. Certainly no other is carried by as many photographers. If your dealer does not carry it, write to the above company at 9 East 41st Street, New York City.

The Haynes Products Company of 136 Liberty Street, New York, manufacture a number of dark-room aids including the MCM Photometer, an exposure meter for use in printing, and the new Gray-Scaler for testing paper. For information on these new items, write to the above company and mention this department.

The Contest Prize Books

The two winners each month will receive their choice of any book on the following list. In addition, their pictures will be published. It may prove possible eventually to put together, from the winning prints and those given honorable mention, an exhibit of from fifty to one hundred prints to be sent on tour to the principal camera clubs throughout the country. We believe that such a traveling exhibit will do much to stimulate interest in Nature photography, and we hope you will add to its value by sending in your prints. Remember, too, that in addition to winning a book from the list, one of the winners will receive a merchandise order for $25 from Willoughby's Inc., at the end of the contest. As we said before, send your entries in early and often.

Each monthly winner will make his choice from this list: "Photo-Lab-Index" by Henry M. Lester; "Nature Photography Around the Year" by Percy A. Morris; "New Ways in Photography" by Jacob Deschin; "The Fun of Photography" by Mario and Mabel Scacheri; "Photography" by Dr. C. E. K. Mees.

Any of these books will be a real addition to your photographic library, and one of your prints may easily bring you the book of your choice, a chance at the $25 final award, or representation in the Camera Trails Traveling Show if this materializes. All you need to do is send as many prints (eight by ten inches or smaller) to Norris W. Harkness, 320 East 42nd Street, New York City. No entry blank is necessary, but be sure your name and address is on the back of each print.

Camera Trails is edited for your benefit, and we want it to be your department including just the kind of help you prefer to find in it. Your letters of criticism or suggestion will be appreciated. We want, too, to help in every possible way with your photographic problems, so feel free to write to Camera Trails whenever we can be of assistance. Address your letters to Norris W. Harkness, Camera Trails, NATURE MAGAZINE, 1214 Sixteenth Street, N. W., Washington, D. C.

A Girl Herpetologist

Add another to our list of young people who wish to correspond with others interested in herpetology, this time Miss Lillian Newton, R.F.D. 1, Milford, New Hampshire. Better get over the idea, boys, that girls are afraid of snakes.

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NATURE IN PRINT

As a convenience to readers the books reviewed in the pages of Nature Magazine may be ordered through the book department of the American Nature Association, 1214 16th St., Washington, D. C.

Plant Experiments

There is two-fold value in the material presented in Volume Five, Number Eight, of the *Science Guide for Elementary Schools,* published by the California State Department of Education. This issue is entitled *Experiments with Plants,* and is prepared by L. Ernest Herz of San Francisco State College. Directed toward the teacher, the guide presents various fundamental plant experiments that teach the actions of plants, and, perhaps more important, the way in which scientific research has brought us our present-day knowledge. Through this bulletin the teacher can aid in laying the foundation of a scientific approach in the youthful mind. These guides are available at $1.25 a year, or fifteen cents a copy, from the California State Department of Education, Sacramento, Cal.

By Clarence Hawkes

Holiday Hopes is the title of a collection of poems by Clarence Hawkes, blind poet, naturalist and lecturer. In these poems, as in other prose and poetry by Dr. Hawkes, there are a simplicity and sincerity that make his work well worth reading. This latest volume is published by the Christopher Publishing House, 1140 Columbus Avenue, Boston, Mass., at $1.25.

To the Himalayas

Most of us must be content as armchair explorers and be satisfied to take our adventure to the far places of the world through books of exploration and adventure. An outstanding opportunity of this sort is provided through *The Throne of the Gods* by Arnold Heim and August Gansser, translated from the original German by Eden and Cedar Paul. It is the story of the first Swiss expedition to the Himalayas, the main object of which was geological. Resultful as it was in this respect, the explorers brought back also a story of adventure of such importance that the Macmillan Company felt that translation and publication in the United States was warranted. They have judged well. Illustrated with many splendid pictures, this is an alluring book. It sells for five dollars.

Hawks

Frank and John Craighead are twin brothers whose interest in wildlife started at a tender age and has continued actively ever since. They have contributed to Nature Magazine in the past, and we know them personally as a fine pair of boys. Their activities have been first in the direction of bird photography, particularly of hawks, owls and eagles that were nesting where picture-taking has been most difficult. Coincidentally, they became falconers. While our enthusiasm for falconry is, to say the least, restrained—because we know it requires particular patience and ability not vouchsafed the average youngster—the Craigheads have practised it with fair restraint and wisdom. All of which brings us to the fact that Frank and John have collaborated to produce a most interesting book entitled *Hawks in the Hand.* It is a story of photography and falconry and adventure in the outdoors. There are fifty-seven reproductions of the boys' fine pictures. Published by Houghton Mifflin Company, the book lists at $3.50.

The Civilized Termites

A farmer leaves a cart in the meadow; all he finds the next morning is the iron. A planter comes home after five or six days away. Nothing seems changed. But: He sits down on a chair and it collapses. He tries to catch hold of the table and it falls to the floor. He leans against the beam and the whole roof comes down in a cloud of dust. These events sound fantastic, but they are the work of termites in the warmer zones and are told in *The Life of the White Ant,* a translation of a work by Maurice Maeterlinck published by Dodd, Mead and Company for $3. Maeterlinck not only tells the fascinating life history of this marvellously civilized creature but also makes it the subject of a stimulating discussion on the philosophy of all life and especially human life. Fifteen photographs illustrate this edition, which also has an introduction by Victor Wolfgang von Hagen. —H. Z.

Snake Field Book

A most valuable and useful addition to herpetological literature is *A Field Book of North American Snakes* by Raymond L. Ditmars, Curator of Mammals and Reptiles at the New York Zoological Park. Fine as is Dr. Ditmars' larger and more expensive reptile book, it is essentially a library volume, inconvenient to take afield. This latest publication will, therefore, find a ready welcome. The book is divided into four main parts, the first dealing with North American snakes generally, their habits, and giving general instructions on identification. The other three parts deal with the snakes of the northeast, southeast and west respectively, each section being provided with a key and treating first with the nonpoisonous and then the poisonous species. Finally there are instructions for the treatment of snake bites and a classified list of North American snakes. Forty-eight pages of plates, specially prepared to aid in identification, supplement the text. Published by Doubleday, Doran and Company, the book sells for $3.50.

BRAZIL BOUND

(Continued from page 12)

that rose on the hill above it. An invisible finger now and again plucked aside a fold in the curtain to reveal the cobblestones in front of the door of a little shop, or a mule laden with bags of charcoal, or, perhaps, an old woman painfully climbing the steep slopes. We followed a stone pathway carpeted by lovely *Selaginella* and little ferns. I had seen lichens and fungi even on the steel railroad tracks, and here they grew everywhere, the vertical rocks through which the path wound being covered with gray-green circular fungi with the texture of velvet and the thinness of parchment. The typical pointed leaves of rain-forest vegetation hung all around us, dripping with mist, and the tops of the trees below us contained gorgeous orange-flowered bromeliads and a host of little tillandsias and orchids, now at the end of their season of blooming. When the mist closed in we saw trees outlined dimly against the ghostly curtain, with swinging epiphytic roots sharply etched across it. Silence! Silence except for the drip of the mist from a million leaf-tips, and, far away, the shriek of a train on the siding. At last a fence of branches, laced together, emerged as out of a cloud, and Joachim announced that we were at the biological station.

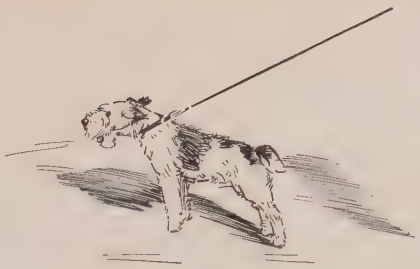
The biological station itself was a wooden, tumble-down building, but aged to a delightful silver gray. A huge aloe was in full bloom in a round red brick "rockery" near the path, and gorgeous scarlet hibiscus trees bloomed at the corners of the prim arbor-vitae hedge that tried to keep out the jungle wilderness beyond. Once in collecting clothes, we walked down the mountain in another direction, poking the fallen yellow leaves with a pointed stick in search of tiny yellow and brown toadlike creatures, *Dendrophryniscus,* which, when found, amusingly "played dead" on the palms of our hands, lying on their backs with the hind legs stiffened and the eyes shut. A rattling little brook, leaping over small stones and forming whirlpools three inches deep with enthusiasm worthy of a better result, yielded a shy green frog, *Crossodactylus,* that sat in rock crevices. It would disappear unless grabbed very quickly. Some aquatic frogs, *Elosia,* big and little, were swimming in the largest of the little pools. Toads hopped among the leaves, and we found tiny *Eleutherodactylus,* the frog that skips the tadpole stage entirely, the young emerging directly from the eggs that are buried in clay or in soft earth. Earthworms and insect larvae were found in the soft sand, and some stones in the brook hid a species of short, broad-beamed crayfish that blundered slowly out, looking more like a fossil trilobite than like its agile, stream-lined relations in North America.

I was struck, however, with the dearth of animal life in places similar to those where we would find it abundant in North America. Stone after stone in the water yielded nothing, and the same was nearly as true of rocks lying on dry land, although I found sometimes a beetle, or a larval insect, or a termite nest. The best collecting was in the axils of the bromelias, where isopods, a few worms, and some tiny silvery insects were living, and where the arboreal frogs spent the day.

The expedition is now a memory. My frogs, fishes and other trophies are safely stowed away in museum jars, and the excitement of the adventure and the sheer beauty of Brazil are past experiences. But sometimes, while I am in the midst of the dry technical descriptions that I must write, the laboratory walls fade away, and I see again the flash of a humming-bird's wing, the purple beauty of an orchid lighting the dark gloom of the ancient trees, or the fuchsia flowers lying like spilled heart's blood on green Brazilian mosses.

Diana Thorne's

DOG COLUMN



WHAT IS KINDNESS TO ANIMALS?

KINDNESS to animals is more or less like every other desirable attribute, a matter of intelligence and understanding. Both of these may be dependent, to no small extent, on early training of the individual.

Last year, three days after Christmas, I chanced to be in one of New York's largest animal hospitals. I was shocked to see a great number of young puppies that had been brought in for treatment. They were the victims of Yuletide abuses by their young, ignorant and irresponsible owners. These puppies had been Christmas gifts. They had been pawed over, fed to excess, given misdirected affection. A great many had died in the vet's hands; the others were wrecks in process of salvation.

Most of the child-owners to whom these puppies had been given had no doubt looked upon the little animals as toys to be played with, handled roughly and put aside as were their inanimate toys. In these cases the child is not so much to blame as are his parents. Children who have not grown up among dogs, or horses, or other animals, and therefore do not know the first thing about handling them, should *never* be given young animals as pets at Christmas, or at any other time, until they have first been taught carefully the meaning of the responsibilities of animal ownership.

Children, as a matter of fact, are capable of being cruel to animals without realizing the enormities of their actions. As I write this, there is a reproduction of a photograph in a current issue of *Life* which shows little children beating rabbits with clubs and leaving them maimed and crawling in agony until their elders put them out of pain.

Very often children, in being cruel, fail to realize the meaning of cruelty, or the meaning of pain, or the meaning of life. Their experience of suffering is limited, and their capacity for sympathy and understanding is undeveloped. I have seen children actually torturing dogs, and other animals, by punishing them because they do not quickly grasp what is required of them, or hitching them to wagons too heavy for them to pull, or by visiting upon them various other abuses. These very children are, also quaintly enough, found to be peevish, fretful and complaining when the animal, frightened or maddened by the cruelty, turns and bites in self-defense.

Certain temperaments should not be entrusted with the care of a dog at all, particularly highly emotional dogs, or those given to sudden rages. Some dogs, indeed, actually develop the habit of snapping and biting simply as a result of repeated mistreatment.

On one occasion, I saw a splendid little wire-haired terrier in a cage in a dog shop. I wanted to buy him. The dog shop owner warned me that he was not a safe dog to have around, that he had been sent in to be sold a month after he had been purchased because his owner said he was nasty-tempered and had bitten several of his guests. He bared his teeth and growled at me when I approached his cage, but after talking to him for a moment, I patted his head. He licked my hand. He came home with me. At home I found him inclined to snap instinctively, but, after a few hours with me, finding that I was neither afraid of him nor unkind to him, he completely forgot his fears, stopped his snappiness and became again what he really was, a well-behaved, happy dog. (Continued on page 61)

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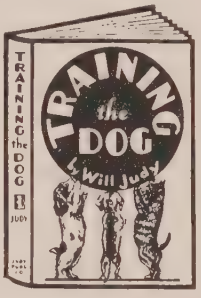

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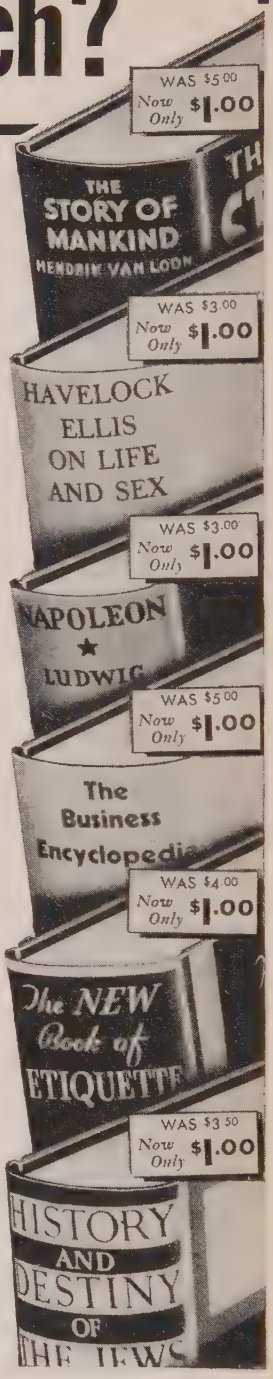

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DIANA THORNE'S DOG COLUMN

(Continued from page 59)

Being peculiarly interested in his case, I made inquiries. I found out that he had been bought as a playmate for a little boy, the spoiled and only son of parents of great wealth, but no traditions. That boy used to lock himself and the dog in a room and sadistically beat the animal while it was tied up. The parents were generally absent on these occasions and it is entirely possible that they were unaware of their darling's amusement. The servants had, it appeared, endeavored to save the dog and also to save the child from himself. But the child, who was a coward as well as a bully, and—naturally—a liar as well, threatened them so that they feared for their jobs and did not report his conduct. The dog had stood the abuse patiently until one day when he turned on the boy. Sheer terror and despair drove him to entirely natural defense. Today "Whiskers" is a merry little dog in a happy household, but he still shows a fear of little boys.

Dogs are naturally fond of children. Also they are naturally gentle with them, but the reverse is not always the case. Children, of course, are not the only offenders in the matter of cruelty either deliberate or unintentional. Otherwise the S.P.C.A. would not have been founded and would not be required. The pity is that it is needed.

California Shrubs

Gardeners in California will find *Flowering Shrubs of California* by Lester Rowntree a useful and informative book. It is a volume that will be of value to the horticulturist and to the lay gardener. Well-written, the book contains many illustrations. The author is widely known for her garden writing and the reader turns to this book for real authority. Published by the Stanford University Press, it sells for three dollars.

Pronouncing Plant Names

We recall a heated argument on the proper pronunciation of *Nicotiana* and wished that we had had on hand to settle the matter a copy of the *New Pronouncing Dictionary of Plant Names*. This handy little paper-bound, 64-page booklet has been compiled by E. R. Robinson of *The Florists' Review*, and is available from Florists' Publishing Company, 508 South Dearborn Street, Chicago, Illinois, for twenty-five cents.

Holboell's Grebe

"Early on the morning of September 25, 1939, after a slow but steady rain that had fallen all the night before, I observed a dead bird on the grounds of Camp Warm Creek DG-82, 26 miles south of Wells, Nevada," writes Claude J. Smith, Biological Survey observer at the camp. "Upon observation and close comparison with descriptions, I identified this bird as Holboell's grebe. Evidently, during the previous night, this bird had flown into one of the several light wires on the camp area, thus meeting its death. It seems well to assume that this bird was on its way to the Ruby Lake Migratory Bird Refuge, located 51 miles south of this camp. It seems to be a rare bird in Nevada, especially in September."

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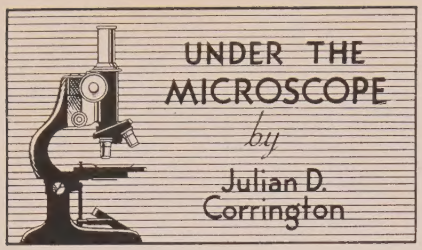


Culturing Bacteria

In the earlier days of bacteriology it was thought that the many species of these one-celled plants could be identified and classified by the same principles as used with diatoms or protozoa—by a reliance upon structural characters. As seen under the microscope, various bacteria differed in many respects, shape of the cells forming a primary classification into spheres (cocci), rods (bacilli) and spirals (spirilla), illustrations of which appeared in our December issue. Each of these groups included large numbers of species that could be subdivided further according to size and presence or absence of such features as spores, capsules and flagella.

As investigation progressed, however, it was slowly discovered that such a morphological (structural) determination of species was not always reliable. Sometimes flagella were present, at other times absent, in the same species; sometimes faulty technique failed to disclose them, the staining of these fine hairs being difficult. Under adverse conditions certain bacteria may develop *involution forms,* abnormal for the species, as when the large rod-shaped anthrax bacilli grow to resemble spirilla in old cultures that have been kept for some while. Other bacteria even take on two or more different shapes under normal conditions, a phenomenon known as *pleomorphism.* Hence a form described by one worker as a rod might be observed by another bacteriologist as a coccus, leading to much confusion.

Today, while identification by structure is still a major feature, even more attention is paid to the method of growth of bacterial colonies in cultures, and it has been found that different species will present characteristic sizes, shapes and colors of masses visible without magnification when grown on or in various nutritive substances termed culture media.

Modern routine technique of the bacteriological laboratory had its beginning in the labors of Robert Koch (1843-1910), who at first grew the anthrax bacillus in the vitreous humor of beef eyes, then later developed solid media that proved superior to liquid preparations and enabled the new science to enter upon a rapid growth. Conditions of absolute sterilization are required, everything that is used being boiled or steamed until all possibilities of contamination have been removed.

Precautions

If you wish to do any work with bacteria it is absolutely essential that you strictly observe each of the following precautions:

1. Never attempt any work at all with the pathogenic (disease-producing) species. Handling such material may be done only under the supervision of a trained bacteriologist. There are plenty of harmless forms, equally as interesting, and there is no need at all for the inexperienced student or amateur to flirt with the undertaker by trying to culture such deadly species as the diphtheria or anthrax organisms.

2. If by accident any materials containing bacteria are spilled, clean up thoroughly and at once.

3. Boil all instruments and glassware after every use of them.

4. Keep the hands away from the mouth, eyes and clothing.

5. Wash the hands thoroughly before and after each session.

6. Follow each of the procedures given in subsequent paragraphs, in regard to sterilizing, tubing, incubating and inoculating, with close attention to detail. Never neglect the smallest step or take any short cuts, but develop the standard routine and use it at all times, whether or not the particular experiment is of any importance.

If these precautions are observed, there is no danger at all in this work, which may be mastered easily and performed by anyone.

Sterilizing

The apparatus needed for culturing bacteria includes a wire inoculating loop, Centigrade thermometer, glassware, hot air sterilizer, steam sterilizer, incubator and tubing stand. We are indebted for descriptions and illustrations of the last four of these items to Earl S. Goudey, of the Bronxville, New York, High School, taken from his article "Young Microbe Hunters" in the June and October, 1935, issues of *Educational Focus,* by permission of Bausch & Lomb.

Minimum requirements in glassware include one funnel, one flask, and three to six each of test tubes and petri dishes. All glassware should first be cleaned thoroughly by placing for 24 hours in a glass-cleaning mixture, the formula for which is here reproduced separately, since it has so many uses in microscopy. After rinsing, place the glassware in the hot air sterilizer at not less than 160° C. for one hour—longer if more convenient. The accompanying drawing for this sterilizer is self-explanatory; any metal cylinder of suitable size may be used. For ease of handling numbers of small pieces of glassware at one operation, place them in wire baskets, beakers, or use coffee cans from which the paper labels have been completely removed and the cans scrubbed clean.

After a few minutes the test tubes will be dry and should then be *plugged* and replaced within the sterilizer. If possible, have a professional bacteriologist, student, interne or physician show you how to plug a test tube properly. Lacking such opportunity, proceed by taking two strips of sterile absorbent cotton and laying them crossways, with a third and smaller piece in the center. Gather this up and force it into the mouth of a test tube for some distance—not less than one-fourth of the tube length—and leaving plenty of the fluffy end protruding. Force in with the butt end of a pencil or a glass rod, then test by holding on to the exposed end of the cotton to see if the plug will support the weight of a tube half filled with water. The plug should also retain its shape when removed. This making of plugs requires practice, but is soon mastered.

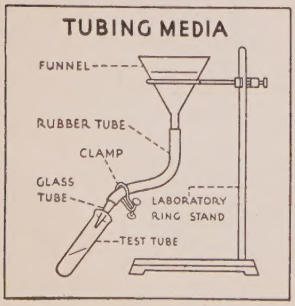
Plugged tubes may be sterilized by boiling in a saucepan for 30 minutes, or heating the dry pan in an oven for one hour at 160° C., but if much work is to be done we advise that you make the hot air sterilizer here pictured or purchase a commercial model.

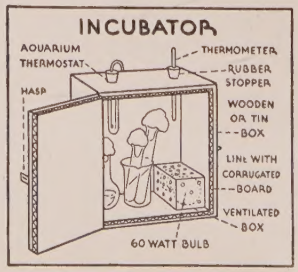
Metal instruments and cultures of bacteria are sterilized by live steam under pressure, and this piece of apparatus may take the form of a professional appliance termed an autoclave, or may be a household pressure cooker, or either a purchased or homemade Arnold sterilizer. The principle involved in the last-named, as shown by one of our illustrations, is to provide a flat tray or pan to contain a wide sheet of water of very shallow depth, so as to produce a quantity of steam quickly when heated, as over a gas stove. A rectangular metal container, such as one of the large tins used for gasoline, motor oil, syrup and other commodities, forms the sterilizer proper, with the bottom cut out and removed, and a small hole drilled in the top center to serve as a vent.

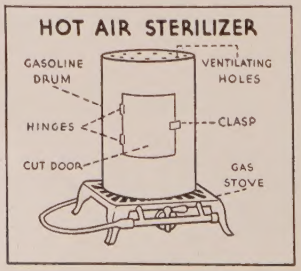
A second and larger tin—not shown in the illustration—is placed around this to form a condensing jacket. Steam rising from the pan fills the sterilizer and maintains a constant temperature of 100° C. and a slight pressure. It then escapes through the vent, cools and condenses to water, and drips back inside the outer jacket into the pan again, the same water being used over and over, with occasional small renewals as necessary. Articles to be sterilized are supported above the water level upon a small metal table or, simplest of all to make, a platform of heavy galvanized screening of ½″ mesh, supported by a fold on each side.

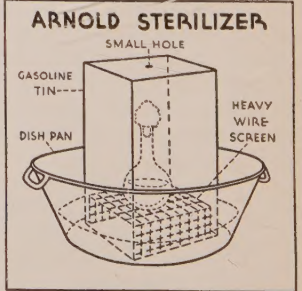
Incubators

Development of bacterial colonies in culture media requires a low-temperature incubator, the source of heat for which may be an alcohol or kerosene lamp, gas flame, electric bulb, or electric heating unit. Many types are on the market, from simple to complex, and the commercial poultry incubator may be









adapted for this work too. One accompanying illustration shows a homemade model, while in our November, 1937, issue we described a slide-dryer made from a gas stove top burner oven, which is admirably suited for use as an incubator. In all homemade models see to it that no inflammable materials are placed near the heat source.

Culturing

By culture medium is meant some decoction of food on which the bacteria will thrive, and the number of such media is legion. We shall describe here three of those most commonly employed; for others consult any textbook of bacteriology.

Nutrient Broth may be purchased ready made or in the dehydrated (dried) form, or may be manufactured in the home laboratory as follows: to 1000 c.c. distilled water add 10 g. peptone, 5 g. Liebig's meat extract, and 5 g. sodium chloride (common salt). Heat until dissolved and add distilled water up to the 1000 c.c. mark to replace that lost by evaporation. Tube and sterilize, as hereafter directed.

Nutrient Agar also may be purchased or homemade. Cook 15 g. shredded or powdered agar in 1000 c.c. distilled water in an agate vessel until completely dissolved (30-45 minutes). While cooking, add 10 g. Witte's peptone, 5 g. Liebig's meat extract, and 5 g. sodium chloride. When finished, add distilled water to the 1000 c.c. mark to make up the loss, cool to 60° C. and add the whites of two eggs. Heat for 30 minutes, then both heat and stir for 15 minutes more, then again add distilled water to the 1000 c.c. mark. Filter through moist cotton. Tube and sterilize.

Potato Slants. Scrub one or more large Irish potatoes until clean. Peel off a large amount, then using a ½" cork borer, brass tubing or an apple corer, take out some long cylinders through the potato, then cut these diagonally into long, narrow wedges. Soak overnight in 1% bicarbonate of soda to correct the acidity. Now put a small bit of cotton saturated with water in the bottom of a test tube and then the potato slant placed so as to rest on the cotton, thus preventing drying out of the potato. Sterilize in an Arnold sterilizer for 30 minutes on each of three successive days. Carrot and cucumber (seeds removed) also make excellent nutritive slants.

Tubing

By tubing a medium is meant the placing of a liquid nutrient in a sterile test tube, best accomplished by having a glass funnel supported in a laboratory ring stand, as shown in an illustration. Plug the neck of the funnel with moist cotton and pour in the freshly-prepared broth or agar. A plugged and sterilized test tube is then picked up with the left hand out of its rack or container and the plug twisted in place with the right hand until it breaks its seal and rotates. Now, holding the right hand palm upward, grasp the protruding portion of the plug between the bases of the middle and ring fingers and remove plug. It must never at any time be placed upon or allowed to come in contact with any other object.

This method of holding the removed plug leaves the right hand free for other duties. With this hand place the delivery tube from the funnel into the test tube and release the clamp, filling the tube one-third full but exercising care not to get any of the medium upon the sides of the tube. Replace plug in tube and proceed to fill the next tube in the same manner.

Some of these filled tubes may be placed upright in a test tube rack, but those containing media which solidify at room temperature are inclined so that the medium will set while on a long slant. All media, after being tubed and replugged, are sterilized in an Arnold sterilizer for 30 minutes on each of three successive days.

The tubes are then transferred to the incubator and held there for several days at 37° C. to make sure that the media are in fact sterile. If bacteria are present in a fluid medium, they will make their residence known by evidences of putrefaction, including cloudiness, gas bubbles, and foul odor; on solid media by developing into colonies of visible size, appearing as white or colored streaks or specks, which continue to grow and spread. If no such evidences appear, the media are sterile and ready to inoculate with forms that one desires to culture.

Inoculating

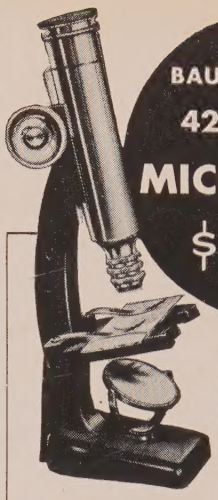
For this step one needs a wire loop, formerly obtainable only in the expensive platinum type, but now available in the much cheaper nichrome wire. Over an alcohol lamp, bunsen burner, or gas stove, *flame the loop,* by heating until red hot, then allowing to cool. Dip the loop into material containing bacteria, securing that small amount the bacteriologist calls a loopful. Sources for specimens would be one or more small receptacles of water containing such things as a dead fly, a piece of meat left a few days to decay in the water, a small particle of feces stirred up in the water, sewage, saliva, dust

GLASS-CLEANING MIXTURE

Sulphuric acid, concentrated, commercial	6 parts
Potassium bichromate	1 part
Hot tap water	4 parts

Dissolve the bichromate in the water and allow to cool. Very slowly and cautiously add the sulphuric acid, a little at a time. This addition generates a terrific amount of heat, which stirring will help to dissipate. If too much acid is incautiously added at one time, the heat produced may crack the container. Never add water to sulphuric acid; always the acid to the water.

This mixture will clean almost anything from glass. After removal of glassware from this solution, rinse in tap water, then in a dilute alkali, as caustic soda, and again in water.



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from the floor, hay or lettuce infusion, pond or ditch or swamp water.

Holding a tube of medium in the left hand, remove the cotton plug as before, flame the mouth of the tube for a few seconds, insert the loop into the medium without allowing it to touch the glass sides or any other object, flame mouth of tube again, replace cotton plug, flame the loop, then place the tube in the incubator for 24 to 48 hours. A slant of solid medium is similarly inoculated by observing all of these precautions against contamination, and by drawing the loop gently along the surface of the slant from base upward, without breaking the surface.

Temperature of the incubator varies with the kind of bacteria one is cultivating. Body temperature, 37° C., is correct for commensal species in or on the body of man or warm-blooded animals, while 20 to 30° C. is best for saprophytes, as those from water, soil, sewage, or dead organisms. Incubation at room temperature is often sufficient for these.

In our next installment we shall go into the methods of plating and streaking for the initiating of pure cultures—those containing but a single species and grown from a single bacterium—as well as the making and staining of permanent slide preparations.

Trade Notes

A new idea in presenting modern biological subject matter is embodied in a voluminous, handsome, yet inexpensive high school text, *A Biology of Familiar Things,* by Bush, Dickie and Runkle, all of the John Adams High School of Cleveland.

Instead of the traditional sequence of standard topics, this 695-page book is divided into ten units only, each taking up some generally known and important phase of life and discussing it in a manner understandable to anyone. Biological facts and principles are introduced as explanations as to why we follow certain practices. For example, there are units on Man in Good Health, and Man and Disease; Biology in the Production of Food and Clothing, and Biology in the Conservation of Soil and Water; Plants for Beauty and Enjoyment, and Pets for Pleasure and Profit.

Methods of approach are unique and very interesting. In the unit on Pets for Pleasure and Profit, for instance, after a discussion of dogs, cats, rabbits and canaries as pets, including their care and training, other and less usual pets lead up to a brief survey of the animal kingdom, while the breeding of pets takes the reader over into novel and excellent surveys of reproduction, embryology and heredity. Teachers will find this organization refreshing, while the individual can read this volume with complete enjoyment, without a technical background. The abundant illustrations are very fine indeed. American Book Co., 88 Lexington Ave., New York City. $1.92.

Again we have an issue of *Watson's Microscope Record* to distribute to those of our readers who will write to Dr. Corrington at the NATURE MAGAZINE address in Washington and enclose a 3c stamp for mailing costs. This is No. 47 and includes articles on new methods of micro-manipulation, photomicrography of rock sections, low-power photography with hand lenses, and many other interesting items.

Introduction and Guide to the Study of Histology, by Dr. Avery E. Lambert, is to be highly commended to those of our readers interested in this important specialty. Both textbook information and laboratory technique are included and the volume is intended for the general reader or student who wishes a suitable background, rather than for the professional histologist. There are 542 pages and 185 splendid illustrations, many in color. The teacher as well as the individual amateur, working alone, will find this a most thorough and instructive book. The Blakiston Company, 1012 Walnut St., Philadelphia. $5.00.

New printings have appeared of the *General Zoology Laboratory Guide* by Professor J. E. Wodsedalek of the University of Minnesota. This work will be quite a revelation to those who have not seen it. There are two volumes totaling 215 pages, full notebook size (8½ x 11"), with craft covers and spiral wire bindings, reproduced by mimeoprint and photo-offset methods, and with 200 exceptionally good illustrations, many of them full-page. We found these books very stimulating and interesting, with excellent organization. Teachers of the subject should inspect them, and the individual who wishes to train himself in modern general zoology could do no better than to use them as guides for his investigations. Burgess Publishing Co., 426 South Sixth St., Minneapolis, Minn. $2.90 per set of two volumes.

Under the Microscope is a department of NATURE MAGAZINE designed for those readers interested in microscopy and maintains a service to render assistance with problems in this field. You are invited to take advantage of this service. Address all inquiries to Julian D. Corrington, NATURE MAGAZINE, 1214 Sixteenth St., N.W., Washington, D. C.

American Society of Amateur Microscopists

President, Simon Henry Gage, Ithaca, N. Y.

Permanent Secretary, Julian D. Corrington, Chestertown, Md.

Official organ, *Nature Magazine*, Washington, D. C.

Address all communications concerning the Society to Dr. Corrington at Chestertown, Md. Application for Membership form sent on request. Dues, one year, fifty cents; two years, one dollar.

Chapter number two is the Leeuwenhoek Chapter of Johnsonburg, Pennsylvania, organized by Virginia D. Wallis and starting off with a membership of twelve. Our congratulations to this active group and also to the Keystone State, which is certainly taking the lead in the installation of chapters.

Which reminds us to remind you that suitable printed forms for chapter petitions are ready, as well as handsome charters. If you reside in a city or are a member of a school or college class, you can find others already interested in microscopy as well as those who can be interested. A minimum of five members is necessary to establish a local Chapter and the Secretary will be glad to advise with you in selection of a suitable name as well as to make suggestions for both temporary and permanent organization. Quite a number of cities already have from three to ten or more members and could easily effect this organization; so get busy and soon you will be enjoying the pleasures and privileges of your own microscope club.

Among recent members may be mentioned Dr. M. Barrie Berryman, photographer, of Salt Lake City, Utah; her specialty is rock sections and mineralogy. T. F. Johnston is a member of the Electrical Engineering Department of Iowa State College, Ames, Iowa, and is interested in bacteriology and in the use of polarized light and the microspectroscope. James William Wylie, of Malverne, L. I., N. Y., is a writer. William C. Wessel is a national executive, Boy Scouts of America, in New York City.

Perhaps even more interesting than professional folk, with specialized education and established position, are the members who have been less fortunate in their advantages but who none the less have a very definite and intense yen toward such a scientific hobby as microscopy. One of these cannot write a single sentence of grammatical English and makes gross errors in spelling and punctuation, yet has more than two thousand dollars' worth of advanced equipment in his private laboratory, and knows all about chromosomes, apochromatic objectives, polarized light and Mallory's triple c.t. staining, etc., ad infinitum. He states that he is a day laborer. Others write that their profession is that of truck driver, shop clerk, salesgirl, miner, errand boy, and a number are unemployed. Hats off to these members who have saved under difficulties to buy a microscope and who know how to use this scientific instrument and how to get the most out of it.

At the present writing the Secretary is trying to solve the problem of reproducing articles with photographic illustrations in a mimeographed Bulletin at reasonable expense. Bulletin #2 is well under way but completion is being held up pending a decision on this point. We feel certain you will like it when it does appear, and once such matters are adjusted, publication can be a little more definite and regular. It is taking quite a long time to get the ball rolling, but that was to be expected since there was so large an amount of ground-breaking and organizing work to be done. Much of the preliminary labor is now behind us and we may expect to go forward more rapidly.

Those who have joined on and after November 1 are having their dues credited for the year 1940 since it seemed hardly fair to collect 1939 dues in the short time remaining. It is not possible for the Secretary to keep records of dates on which each member's dues would become payable, as is the case with a magazine. Like other societies, ASAM dues are annual, without regard to month or exact day. Accordingly, all those who joined prior to November 1, 1939, and who have not already paid up for 1940, should remit fifty cents for the new year. If each member will take this responsibility it will not be necessary for the Secretary to waste his time and the Society's funds in billing each person for his dues.